TWENTY-FIRST ANNUAL REPORT

OF THE

SECRETARY

OF THE

STATE HORTICULTURAL SOCIETY

OF

MICHIGAN

1891

BY AUTHORITY

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REPORT OF THE SECRETARY

OF THE

MICHIGAN STATE HORTICULTURAL SOCIETY.

ALLEGAN, MICHIGAN,
December 31, 1891.

TO HON. EDWIN B. WINANS, *Governor of the State of Michigan:*

I have the honor to submit herewith, in compliance with legal requirement, the accompanying report of 1891, with supplementary papers.

Respectfully yours,

EDWY C. REID,

Secretary of the Michigan State Horticultural Society.

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OFFICERS

OF THE

STATE HORTICULTURAL SOCIETY FOR 1892.

PRESIDENT—T. T. LYON, South Haven.
VICE-PRESIDENT—CHAS. W. GARFIELD, Grand Rapids
SECRETARY—EDWY C. REID, Allegan.
TREASURER—S. M. PEARSALL, Grand Rapids.
LIBRARIAN—ROBERT L. HEWITT, Lansing.

EXECUTIVE BOARD.

L. R. TAFT, Agricultural College, 1 year.
L. W. WATKINS, Manchester, 1 year.
R. MORRILL, Benton Harbor, 2, years.
C. J. MONROE, South Haven, 2 years.
CHAS. W. GARFIELD, Grand Rapids, 3 years
CHAS. A. SESSIONS, Mears, 3 years.

STANDING COMMITTEES.

ON FRUIT CTALOGUE, T. T. LYON, South Haven, Chairman; 1st district, L. B RICE, Port Huron; 2d district, E. H. SCOTT, Ann Arbor; 3d district, D. G. EDMISTON, Adrian; 4th district, W. A. BROWN, Benton Harbor; 5th district, GEO. C McCLATCHIE, Ludington.

ON NEW FRUITS—T. T. LYON, Chairman; C. A. SESSONS, Mears; S. R. FULLER, Eaton Rapids; C. ENGEL, Paw Paw.

ON FINANCE—C. J. MONROE, R. MORRILL, C. W. GARFIELD

ON ENTOMOLOGY—ALBERT J. COOK, Chairman.

ON VEGETABLE PHYSIOLOGY—L. R. TAFT, Chairman.

ON LANDSCAPE GARDENING—JAMES SATTERLEE, Chairman

ON VEGETABLE GARDEN—W. W. TRACY, Chairman.

ON FORESTRY—C. W. GARFIELD, Chairman, Grand Rapids; L. R. TAFT, Agricultural College; C. A. SESSIONS, Mears.

THE YELLOWS LAW.

AN ACT to prevent the spread of yellows, a contagious disease among peach, almond, apricot and nectarine trees, and to provide measures for the eradication of the same, and to repeal act thirty-two of the session laws of eighteen hundred and seventy-nine.

SECTION 1. *The People of the State of Michigan enact*, That it shall be unlawful for any person to keep any peach, almond, apricot, plum, prune, cherry or nectarine tree, infected with the contagious diseases known as yellows or black-knot, or to offer for sale or shipment, or to sell or ship to others any of the fruit thereof; that both tree and fruit so infected shall be subject to destruction as a public nuisance as hereinafter provided, and no damage shall be awarded in any court in the State for entering upon premises and destroying such diseased trees or parts of trees and fruit if done in accordance with the provisions of this act; and it shall be the duty of every person, as soon as he becomes aware of the existence of such disease in any tree, parts of trees, or fruit owned by him, to forthwith destroy or cause said fruit or trees to be destroyed.

SEC. 2. In any township in this State in which such contagious disease exists, or in which there is good reason to think it exists, or danger may be justly apprehended of its introduction, as such information becomes known to the township board or any member thereof, it shall [be] by the duty of said board to appoint forthwith three competent freeholders of said township as commissioners, who shall hold office during the pleasure of said board, and such order of appointment and of revocation shall be entered at large upon the township records.

SEC. 3. It shall be the duty of said commissioners, within ten days after appointment as aforesaid, to file their acceptance of the same with the clerk of said township, and said clerk shall be ex officio clerk of said board of commissioners, and he shall keep a correct record of the proceedings of said board in a book to be provided for the purpose, and shall file and preserve all papers pertaining to the duties and actions of said commissioners, or either of them, which shall be a part of the records of said township.

SEC. 4. It shall be the duty of the commissioners, or any one of them, upon or without complaint, whenever it comes to their notice that either of the diseases known as yellows or black-knot, exists or is supposed to exist, within the limits of their townships, to proceed without delay to examine the tree or fruit supposed to be infected, and if the disease is found to exist, a distinguishing mark should be placed upon the trees and the owner notified personally, or by a written notice left at his usual place of residence, or if the owner be a non-resident, by leaving the notice with the person in charge of the trees or fruit, or the person in whose possession said trees or fruit may be. The notice shall contain a simple statement of the facts as found to exist, with an order to effectually uproot and destroy by fire, or as the commissioner shall order, the trees so marked and designated, or such parts thereof within ten days, Sunday excepted, from the date of the service of the notice; and in case of trees known as nursery stock, or fruit so infected, such notice shall require the person in whose possession or control it is found to immediately destroy the same, or cause it to be done, said notice and order to be signed by the full board of commissioners.

SEC. 5. Whenever any person shall refuse or neglect to comply with the order to remove and destroy the tree, or parts of trees so designated and marked by the commissioners as aforesaid, it shall become the duty of the commissioners to cause said tree or parts of trees to be removed and destroyed forthwith, employing all necessary aid for that purpose. The expenses for such removal and destruction of trees or parts of trees, to be a charge against the township, and for the purpose of said removal and destruction, the said commissioners, their agents, and workmen, shall have the right and power to enter upon any and all premises within their township.

SEC. 6. If any owner neglects to uproot and destroy, or cause to be removed and destroyed as aforesaid, such diseased tree or parts of trees or fruit, after such examination and notification, and within the time hereinbefore specified, such person shall be deemed guilty of a misdemeanor, and punished by a fine not exceeding one hundred dollars, or by imprisonment in the county jail not exceeding three months, or both in the discretion of the court; and any justice of the peace of the township where such trees may be, or where such nursery stock or fruit is sold, shipped, disposed of, or delivered as aforesaid, shall have jurisdiction thereof. The words "parts of trees," wherever used in this act shall refer to black-knot only and not to trees affected with yellows.

SEC. 7. The commissioners shall be allowed for services under this act, two dollars for each full day and one dollar for each half day, and their other charges and disbursements hereunder, to be audited as well as any other charges and disbursments under this act, by the township board all of which costs, charges, expenses and disbursments, may be recovered by the township from the owner of said diseased fruit, or from the owner of the premises on which said diseased tree stood, in an action of assumpsit.

SEC. 8. All of act number one hundred and seventy-four of the public acts of eighteen hundred and eighty-one, be and the same is hereby repealed.

This act is ordered to take immediate effect.

Approved June 23, 1891.

PROCEEDINGS OF THE WINTER MEETING

HELD IN LANSING, MICHIGAN, MARCH 23 AND 24, 1891.

The March meeting of the State Horticultural society was called chiefly to consider several bills in the legislature, relating to horticultural interests, as well as the part Michigan horticulturists should have in the World's Fair.

The first session was held on Monday evening, the 23d, and was opened by President LYON with a brief account of his journey to the west last winter, visiting several state societies in the interests of the pomological division of the U. S. Department of Agriculture, on the topic,

PENDING LEGISLATION.

Mr. C. W. GARFIELD was first called out. He said that as to the World's Fair, Senator DORAN has a bill appropriating money for a horticultural exhibit, but it would probably be absorbed by a general appropriation for all the state's interests, and this society has already indicated its willingness to have horticulture take its chances for representation in that bill and a fair share of the fund by it provided. Another bill proposes to do away with the state forestry commission. This should not pass. That commission did good work with the small amount of money provided. We can not at present do such a great work as New York is undertaking in the preservation of the Adirondack region, but to do away with the commission would be to place us back where we were before, wholly dependent upon voluntary effort to educate the public and otherwise advance the interests of forest preservation or establishment. Still another bill proposes to abolish the weather service. This has done and is doing very much to help the farmers and fruitgrowers in various ways, and is now making special efforts in our interest, in such matters as records of temperature and rainfall throughout the state. It was early efforts in this direction by this society, that had very much to do with establishment and advance of horticulture in this state.

Prof. A. J. Cook spoke of the pending bill to protect bees from death by arsenical spraying of fruit trees. He read the bill and said that the state beekeepers' meeting had resolved to look after and secure its passage. It simply forbids, under penalty of not less than $5 for each offense, the spraying of fruit trees, shrubs, and vines, with arsenical or other poisonous solutions, while in bloom. There have been considerable losses of bees in Michigan by this means, especially in Kent county. He thought no litigation was likely to arise through passage of the bill, but it might be made protective to beekeepers where some fruitgrower might be indifferent or uninformed. Notice to such of the existence of the law would be sufficient. Damage to bees might be very great indeed, as it has been in Illinois, before the legislature of which state a similar measure is pending. If the period of blossoming were the right time to spray, the case would be quite different; but the fact is that it is not in any sense the time—spraying would be entirely useless then.

Mr. Parks of Lansing thought the bill a good one. Fruitgrowers should know that the time of blossoming is not the time to spray, and the bill will help teach them that fact.

L. B. Rice of Port Huron: If it kills the bees does it not injure us as fruitgrowers? The less bees, the fewer carriers of pollen for fertilization of blossoms.

Prof. Cook: Had I been talking to the legislature I would have said that, but every horticulturist knows it. Horticulture could not be carried on without the aid of bees. Perhaps we might grow strawberries, but the bees help even there.

Prof. L. R. Taft hoped some such act might pass. Bees do help greatly, even as to strawberries.

A. G. Gulley of Agricultural College: A few years ago, speaking as a fruitgrower, I would not have favored this bill, because we were then very fearful of yellows, which disease bees are believed to disseminate; but peach-growers have no such fear of yellows now, and so have no feeling of opposition. As to spraying for curculio, it must be done early if it is to be of any use at all, perhaps even before the blossoming.

Prof. Cook: In experiments I have never gotten any curculio until after the plum blossoms fell; so it is of no use till then, if indeed it is of any use at all.

Senator Taylor explained the situation of the bill in the senate. Opposition was made upon its introduction, but it proceeded upon the idea that the bill is disadvantageous to fruitgrowers; but if such is not the case, there is no objection to its passage.

Mr. Garfield said fruitgrowers were of but one mind upon this subject,

and moved to refer the matter to the committee on resolutions with instructions to report in favor of the bill. It will not educate the horticulturists, but it will protect beekeepers. He did not believe in educating in that way; would rather have the money the passage of the bill would cost, to disseminate horticultural information; he did not like the tendency to shift all responsibility for public enlightenment upon the legislature, but favored this bill for sake of the beekeepers.

Secretary Reid moved that the committee be requested to report also in favor of the bill to prevent spread of black-knot in plum and cherry trees.

Mr. Garfield: Has not apple scab done more damage than black-knot?

A Voice: Yes.

Mr. Garfield: Then why shall we not legislate upon that? And on the curculio? Where would we end?

President Lyon: In California, where horticulture is carried on scientifically and with so much thoroughness, all these points are covered by laws. It would be well to do so here; only, as to the apple scab, we do not yet fully know what the remedy may be. If we did, it would be well to cure the evil in that way.

Mr. Reid's motion was adopted.

H. Bird, Jr., of Douglas said, as to desirability of laws for such purposes, the yellows law, spoken of by Mr. Garfield as needless at South Haven, because every man voluntarily cut out diseased trees, was necessary about Douglas and Saugatuck and had to be enforced at cost of considerable effort.

Tuesday Morning Session.

The president appointed Messrs. L. B. Rice of Port Huron, E. W. Allis of Adrian, H. Bird, Jr. of Douglas, and C. J. Monroe of South Haven, a committee on resolutions.

H. Oscar Kelly of St. Louis, read a paper upon

THE POSSIBILITIES OF SUCCESSFUL COMMERCIAL HORTICULTURE IN GRATIOT COUNTY.

In this article I shall not attempt an exhaustive discussion of the subject, but shall, if possible, advance a few ideas which I hope will be of some benefit to those who may manifest sufficient interest to give their attention. By the term "horticulture," as applied to that branch of commerce of our peninsular state, we must include the four distinct divisions of pomology, or that division which pertains to the growing of fruit; floriculture, or that which pertains to the cultivation and care of flowers; gardening, or

the growing of vegetables, etc., for the market—and we may also very properly include the house or family garden; and arboriculture, or that which pertains to to the care of the forest, and the cultivation of forest and ornamental trees and shrubs.

The division of which I shall treat in the main will be confined to pomology, or the art of growing and marketing fruit, and the territory shall be confined to our own county of Gratiot, portions of which, though situated within the bounds of the lowlands of the valley of the Saginaw and Maple Rivers, giving a very imperfect system of atmospheric drainage, has, by actual test, proven itself admirably adapted to the growing of small fruits of nearly every description; also an abundant supply of garden vegetables, etc., for the market, at highly remunerative prices.

Lying, as it does, between the 43d and 44th parallels of latitude, and to such a distance in the interior of the state as to be beyond the range of the influence of that great climatic equalizer, lake Michigan, we must not for a moment foster the idea of entering into successful competition with the great "fruit belt," in the cultivation of that best of all semi-tropical fruits, the peach. However, what our county lacks in climatic influences is fully overbalanced in the fertility of the soil. Our soil is mostly of a clay loam, and heavy clay subsoil retains the properties of fertilization to a great extent. Thus, we see, the expense of keeping our soil in proper condition conducive to the development of plant life, would be reduced to a minimum, on account of its nearness to its virgin state. Virgin soils generally contain sufficient quantities of all the elements of plant life to supply an abundance of food, but if they are continuously cropped, and none of the elements replaced, the time will come when one or more of the elements will become reduced or exhausted, and the plants will no longer be able to bring their fruit to a perfect state of development.

While the proportions in which the elements occur in plants may vary within certain limits, yet no plant can grow unless it has provided for it, always in soluble form, eleven elements, viz.: Oxygen, hydrogen, nitrogen, carbon, potash, phosphoric acid, lime, magnesia, iron, sulphur, and soda, while chlorine and silica are generally present. The elements most likely to fail are potash, phosphoric acid, and nitrogen. Here in our county, we have, or can obtain, that safe and reliable but too much neglected fertilizer, unleached wood ashes. They contain all the mineral elements inherent in the trees from which they came, and therefore they will furnish to other trees and plants, in an easy and soluble form, approximately, the elements which they require. Potash applied to plants greatly increases the amount of sugar which their fruits contain, and in other ways improves the quality, also making strong, vigorous plants which are much less subject to disease, and if attacked are less injured than weak ones, potash being of itself a fungicide.

What are the essential elements of success in a fruitgrower and market-gardener? He must be an enthusiast and love the occupation of his choice. He must be a careful and persistent observer of the different stages, conditions, and habits of plant growth, and note the relative circumstances under which his productions are brought to the highest degree of perfection, being always on the alert to discover means for improvement in pruning, care, and cultivation; and last, but by no means least, he must be truthful, upright, fair, and honest and tasty in the packing, preparation, and sale of his products.

What shall we produce? In the line of fruits we will begin with the

strawberry, as that is the first fruit of the season, and therefore should receive first attention. The strawberry (*Fragariæ*) is indigenously at home in Gratiot county, as practical experience has most admirably proven. Therefore the production of this favorite fruit is no skeptical experiment, but an established success. Varieties under consideration have been very limited. The once "grand old standby," but now somewhat obsolete, the Wilson, has stood the test of many years, and this variety, it may almost be said, has been the fundamental means of developing the now extensive industry of commercial strawberry culture. More recently, it is very commonly attacked by that troublesome enemy of the strawberry plant, the fungus (*Sphaerella Fragariæ*), for which reason, together with the rivalry of more modern varieties, it is to some extent falling into disuse. Gratiot county growers are greatly behind the times; and as those kinds which succeed in one locality do not always succeed in another, actual test is necessary to a choice.

Next comes the raspberry, and in this, especially the blackcap, we believe, lies the superstructure of successful commercial small-fruit growing. It is with the blackcap that we may assert our great natural temperament of independence, for, in case of a glutted local market or great distance from the large city market, we may resort to the evaporator with an assurance of certain success and a greater profit than that of any other known evaporated product. The red varieties must depend wholly upon local demands. In our county neither of these are receiving the attention they justly merit, although both are adapted to our soil. These, in company with the currant and gooseberry, should receive greater attention.

Immediately following we have the blueberry, or huckleberry familiarly called, which has received no particular attention in a cultivated way, though in other localities it has been brought to a superior state of perfection. Of this we have, during the past season, placed a few plants on our experimental grounds and will watch development with interest.

In the larger fruits we have the cherry, the plum, the grape, the pear, and the quince, all of which may be grown with a quite certain degree of success and profit.

Lastly upon the list we place the "king of fruits," the apple. This fruit is unmistakably the leading commercial commodity in the fruit line, of our own county if not the state. The western and southern portions of our county are most admirably adapted to this already gigantic but growing industry, and we would most heartily endorse a movement to encourage an increase in the production of this staple fruit.

We are often met, however, by the assertion that if the fruit industry advances, an over-production and glutted market, causing a disastrous failure, would be the result. True, the marketing of fruit is fully as important as fruitgrowing, therefore we consider it necessary to dwell at some length upon this important question. In this direction we heartily endorse the views of T. T. Lyon of the State Horticultural society, who says:

To meet this competition we must make our own fruit fit to eat, and that is more than can be said of the stuff now grown and called best market varieties * * * There are plenty of men ready to pay any price for the best fruits if they can only be secure in their supply. This is the only way we can make head against the increasing consumption of southern fruits. We can send good apples south and sell them for more than the price oranges sell for there.

Thus we see from this statement of President LYON, founded on actual experience, that the prime cause of glutted markets is traceable directly to shiftlessness or carelessness, and in more cases than one, a sprinkling of dishonesty in selecting, assorting, and packing fruit for market. We have found and proven by actual test, during the past season, in handling apples at Grand Rapids, that by taking from one bushel of apples the small, inferior fruit in amount so astonishingly small as to be almost unnoticeable, the quality of the remaining fruit was raised fully twenty per cent. The same rule is equally applicable to all fruits.

Again, we quote from Mr. ROLAND MORRILL of Benton Harbor:

In the first place, I will venture the assertion that we have not yet reached the point where we produce any surplus fruit of any kind at any season of the year, except perhaps in the case of apples in occasional years; and that, if called upon to furnish all the markets accessible to us with good fruit (*i. e.*, fruit fit to eat) we could not do it at any price, and the fault is all our own. We have been very diligent in planting and growing large tracts of fruit in our fruit regions proper; but few of us have spent very much time looking up an outlet for all this crop which is sure to come and is nearly always upon us before we are properly prepared for it. Then we load it all up, good, bad and indifferent, and hustle it off by the most convenient route to the large markets, hoping against hope that we may realize something from it, and all of us doing the same thing at the same time. No wonder the market is glutted. * * * It seems very difficult to get the fact into the brains of some fruitgrowers, that inferior fruit is the one great snag against which they invariably run, in all our large city markets, and they place the snag there themselves. Nobody asks or wants them to. The commission man begs them not to send it, the buyers curse them, the consumer becomes disgusted and uses a great deal less of it than he would if he could get what he wanted at all times. There are two kinds of inferior fruit. One is all poor, for which the owner should be thankful if he gets enough money to pay expenses. The other is the kind which is very inferior at the bottom of the package and very fair or choice on top. A great many men grow this kind entirely, and we annually hear mourning from their camp. They say "The market is glutted," "Fruitgrowing don't pay," and "The commission men are thieves," etc. The fact is, they should not grow that kind of fruit. It does not pay, it destroys the confidence of the consumer, and he buys just as little as he can (this alone causes a glut). Besides, it establishes low prices for good fruit. Of course, there is a certain amount of good fruit on the market at all times, on which the owner has made a good reputation. This never fails to sell above the market, and usually brings the owner a good profit.

If all growers would ship only good fruit, honestly packed in standard packages, the prices would certainly be satisfactory and it would have an influence toward better cultivation and better methods generally. In order to produce more prime fruit to supply the demand, which would certainly increase as fast as the supply, we often hear men say that the proper way to pack fruit is to "top it off." They say everybody else does so and that is excuse enough for them. Of such I would ask, if my neighbor is a rascal, is that any reason why I should be one?

We of Gratiot county have full and easy access by rail to many of the leading markets of the state. By the D., L. & N. railway we reach Saginaw and by direct connecting lines reach Bay City in from one to two hours and Grand Rapids in three to five hours. By the T., A. A. & N. M. railway we may reach Owosso and the cities of the south and the numerous summer resorts of the north. By the T., S. & M. railway we reach the lake ports of the west shore, and by direct connecting navigation lines we gain access to the great western distributing city of Chicago, and many other points. Our transportation facilities are unexcelled.

The length of our paper will permit of scarcely a passing note on forestry and the influence of the forest upon the productiveness of our cultivated crops. But, if asked if the wholesale slaughter of our forests

should be continued, our reply would be most emphatically in the negative. Protect your woodlands as you would your garden.

Mr. PARKS having remarked that farmers should grow better apples, Mr. W. H. OVERHOLT of Eden said they first must learn how and next must practice it, but they do neither. Most of them have not yet learned about spraying. He grows berries and finds it pays to grow only the best. He got, last season, ten cents net per quart for raspberries to go to Chicago—they were extra fine and were wanted at the Palmer House. He has two evaporators and two kilns, the latter used for drying cores and small apples. He puts nothing through the evaporators but was good cooking fruit before it entered—no Phœnix nor "Pumpkin Sweets"—and so the entire product went as a fancy grade. By spraying he had secured fine pears.

THE WHORTLEBERRY.

An inquiry was made if any one knew of successful efforts to grow whortleberries on upland.

The secretary said H. J. RAY of Watervliet has so grown them for several years.

Mr. PARKS knew of whortleberries growing on dry ground, wild, in New York.

Mr. ALLIS: Are there not many varieties of whortleberry? I think I can find in Lenawee county fifteen different kinds.

Prof. L. R. TAFT: There are a dozen or so species and many variations, perhaps 100 in all, there being great difference in height of the bushes and size and color of the fruit.

HORTICULTURE AND THE WEATHER SERVICE.

Sergt. NORMAN B. CONGER, director in charge of the Michigan weather service, was to have talked about "Horticulture and the weather service," but was detained by the death of a relative, and Prof. L. R. TAFT served in his stead. He said: The subject is one that is wide in its scope and one that can not be fully treated in all of its branches in the present paper and it is the intention only to call attention to the most important parts, which may suggest new and valuable thoughts to those who have made a special study of horticulture in this state.

Michigan has a climate which is peculiarly her own, and no other state can produce the climate changes which occur during the year in the different portions of the state.

In this state we can find almost any kind of climate that is best adapted to our special purposes, and it is for the weather service to find the different changes in climate and place them before the public for their use and information.

Nothing enters so into our daily lives as the weather conditions, and while these are in a measure inconstant, yet at the same time they leave indelible marks whereby we may trace their passage through the state and also the effect they have on different portions of the state.

The subject of the amount of rainfall in Michigan, and its distribution, and the temperature lines of the state, is one which is of no little importance to those engaged in producing fruit or cereals.

The "peach belt" of Michigan has been long an established fact, yet the reasons or cause for it have never been satisfactorily explained. Although the cause has been hinted at, yet the collection of the temperature and rainfall data of the state shows conclusively why this fruit can be successfully produced on the west side of the state, and also why it can not be made a success in other portions, soil of course being equal in all cases.

The temperature lines of the west side of the state are several degrees higher than in the central portion or the east portion. For instance, it is as warm in the Grand Traverse region as it is in the extreme southern tier of counties in the east half of the state.

During the winter season the warm air from the lake is carried over the state, its warmth is taken out as soon as it strikes the cold land, and is not conveyed far into the interior. The lake is probably never frozen over entirely, and therefore the water must be above thirty-two degrees and will probably be found to be about thirty-four degrees, and the winds blowing over this large surface of water absorb the heat from the water and carry it to the land, where it is transferred to the colder ground, keeping the temperature of the "peach belt" higher than it is in the interior. Again, in the spring of the year, the case is reversed, as the land warms up rapidly under the influence of the warm rays of the sun, and while in the interior the trees are putting forth their leaves and buds, which are liable to be nipped by the frosts, those in the "peach belt" are still retarded by the cool winds from off the lake and the buds do not come out until after the danger from killing frosts has passed. Thus the lake acts in both cases as a care taker of the fruit trees on the west side of the state.

During the fall of the year the prevailing southwest winds, carrying the warmth from the lake, allow the trees to gradually prepare for the winter and keep them from the sudden changes of temperature which injure the trees of the interior, and in the spring the reverse applies as has been stated. These are considered to be the principal causes for the rich production of fruit on the west shore of the state.

These causes have been partially understood, and Prof. Winchell rightly surmised this effect in his study of the climate of the state; but having so little data to work with, the full significance of this was not brought out.

It has been one of the first duties of the weather service to construct temperature and rainfall charts which show graphically these facts, and they are so constructed that any one can understand.

Three of these charts, showing the normal temperature lines in the state, are here shown, first the September chart, which shows the beginning of the downward curve of the temperature; second, the January chart, which displays the winter dip of the temperature, and third, the May chart, which displays the reverse curves and explains the cause for the retarded growth in this region, while other portions of the state are

so much warmer. The fourth shows the average yearly rainfall as determined by thirteen years' observation.

A careful study of these charts reveals much that is valuable to the horticulturist, and should lead him to investigate the distribution of the rainfall and the temperature lines for the entire year, both of which have been coustructed and published by the weather service for the information of the people of the state.

Again, many of those who are interested in growing fruit, both large and small, are experimenting with new varieties, to see if they are profitable. In many cases these experimental plants or trees die before they come to maturity, on account of the climatic conditions which are not favorable to their sturdy growth. This is where the weather service should be of great value to you, and it is this information which you should freely use.

It is supposed that the nurseryman who grows the tree knows, to a certain extent, the climate conditions most favorable to the best development of the tree he sells you—that is, how much moisture is needed, and how low a temperature it will stand; whether it will stand sudden changes of temperature, if it is what is called a hardy tree or whether it is of a sensitive temperament. With this knowledge and the information which the weather service furnishes, you can readily judge whether the tree will be likely to be a success or not, and it should not be necessary for you to experiment for several years and then lose your tree from winter-killing, when you can have this information before you start in with the experiment.

The data which has been compiled in the weather service office reaches nearly every county in the state, and a larger portion of it is such that fairly reliable normals can be given relative to the average amount of rainfall, the humidity, and the average or normal temperature and the extremes that may be enacted in the different localities.

In the past four years that this service has been working, it has been found that the temperature lines each month follow very closely the same general outlines as the normals would indicate; that is, although the temperature may be higher or lower than the normal, yet the general contour of the lines is the same.

Investigation relative to the "frost lines" of the state is now being carried on and in the preliminary study it is found that they are as distinctly marked in this state as are the temperate lines or the distribution of rainfall. The central portion of the state is much more liable to late frosts in the spring, and early frosts in the fall, than are the counties on the east or west borders of the state.

These lines are well marked, and with further time to justify the data now in hand, it is thought that there will be no doubt of the fact that this may be laid down, and frost predictions made with considerable reliability for sections of the state, and not a general prediction for the entire state as is now made.

The use that this information can be put to, is not a difficult problem to solve, when it is recalled that the serious study of the climatic conditions over the United States, and of bringing it nearer home in our own state, is of recent date, as the national service has been working only some twenty years, and the serious study of the climate of our own state, so as to cover it as a whole, but four years, and that the investigation of the effect of rainfall and temperature on trees and cereals is practically in its

infancy and that the information which this study will bring forth, for the benefit of horticulturists and agriculturists, can not be doubted for a moment.

The transfer of the national bureau from the war to the agricultural department promises to bring out these very facts, and the investigation of the effect of climate on fruits and cereals will be one which will undoubtedly be undertaken very early, and as this subject is now challenging the careful attention of those who have made a study of the subject, it will soon develop a new field of information which will be of great value.

The study of these conditions can not be made without the data for making the study, and the weather service is gathering this data at a very small expense and placing it in shape so that it can be readily used for this purpose. It is not the only function of the service to collect this data and publish it for the information of the citizens of the state, but more especially to gather it and put it into shape so that this very investigation may be carried on and some general benefit derived by all classes.

Some trees or grains prosper better in some counties (soil being equal) than in others, and there must be some good reason for this; and if, as surmised, it is the temperature or rainfall, then let us have the information so that we can designate these counties and use the fruits and cereals that are best adapted to those portions of the state.

Temperature and rainfall are not constant in their action; that is, if the average for Allegan county for June is sixty-three degrees of temperature and four inches of rainfall, it is not to be said that these will occur every year, but at the same time we can from this data establish a normal of what is rightly to be expected, and from this normal show the effect that is to be anticipated on the fruit or grains, and the consequent yield.

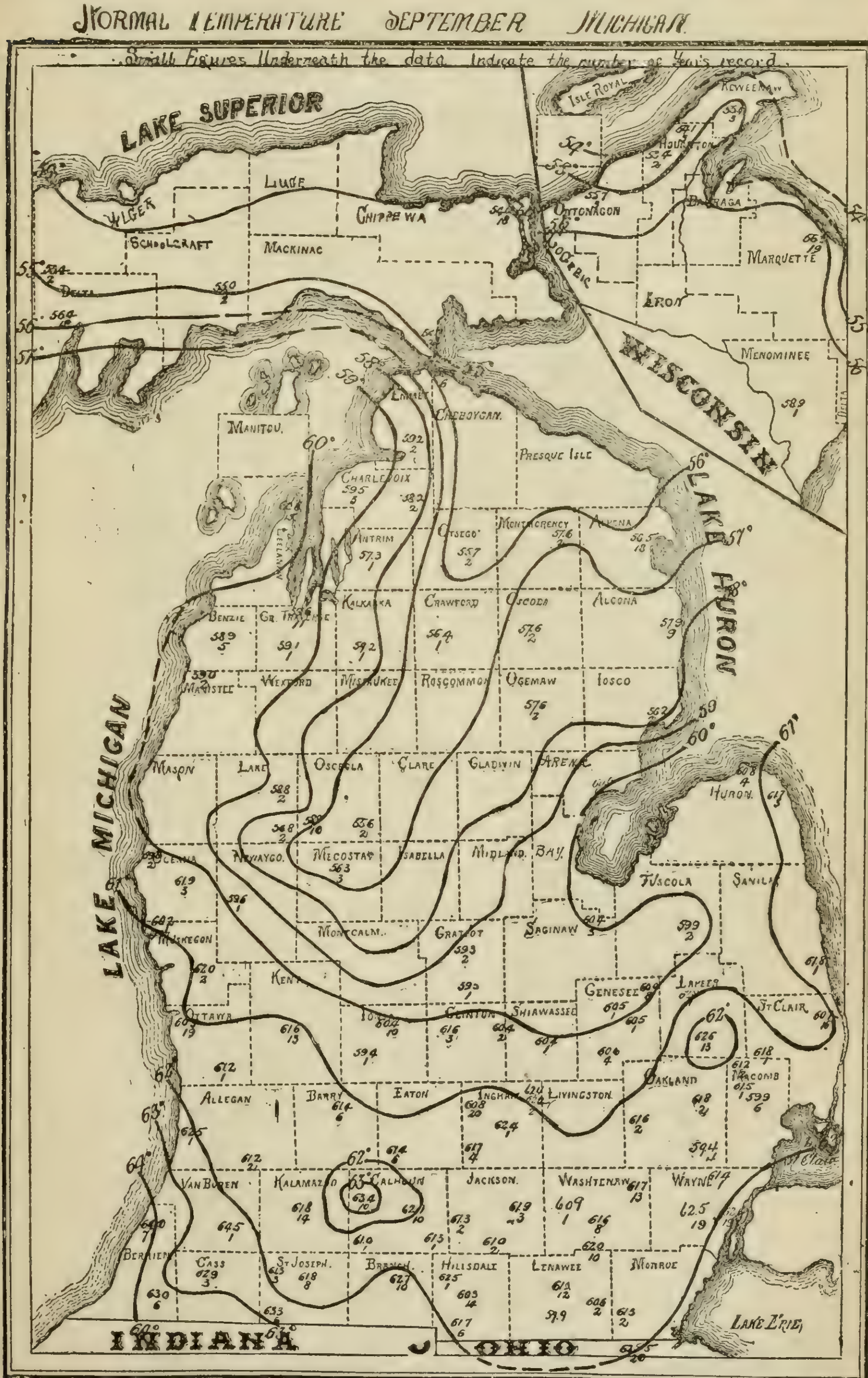
This information is now being furnished by the service and the experience of the past three years would go to uphold this belief and that the statement is founded on fact.

The service furnishes each week during the growing season a bulletin which gives the normal temperature for each day, the average daily for the period, and the total amount of rainfall and its distribution over the state.

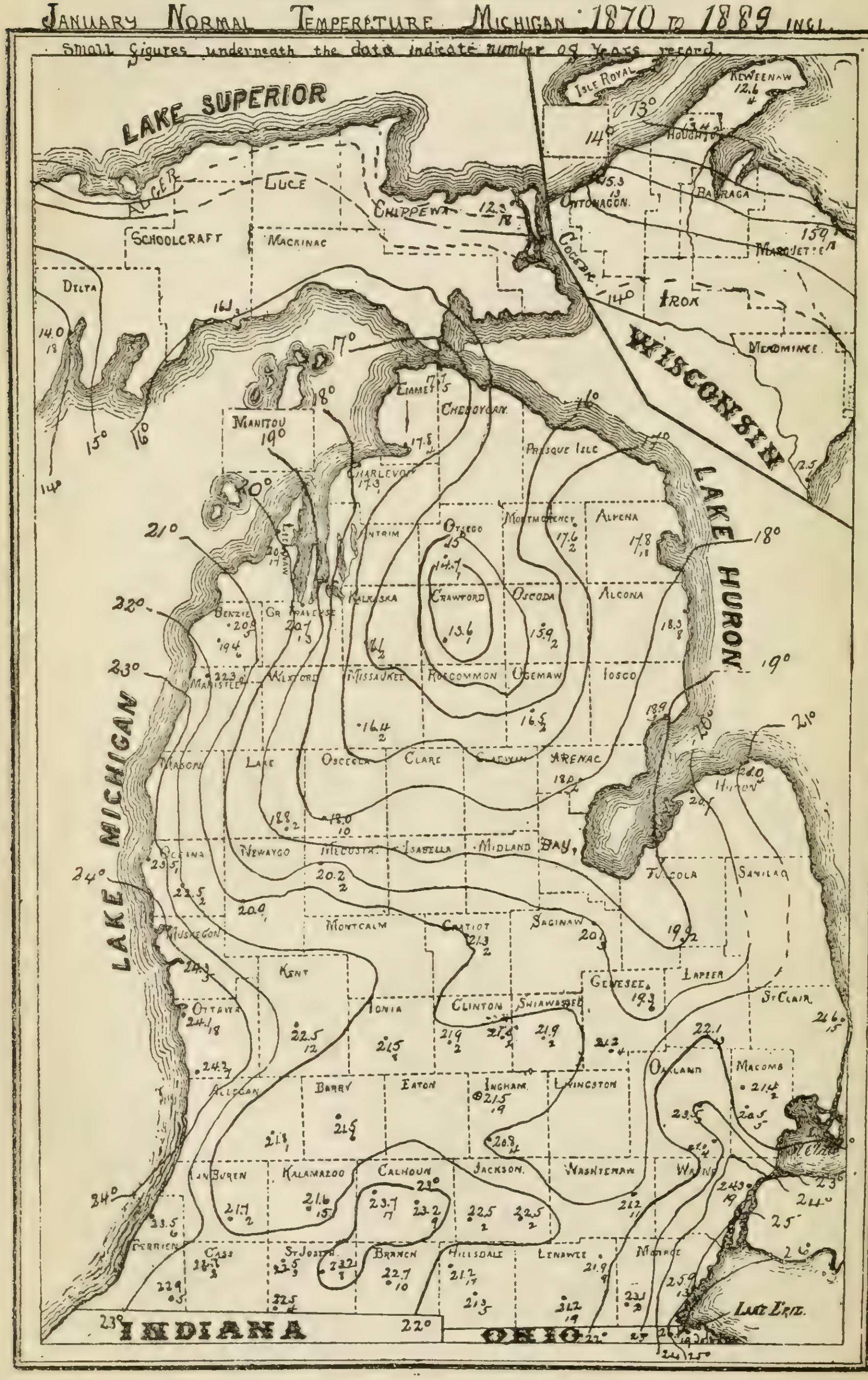
This information keeps you informed of the progress of the crops during each week of the season, and can be made of use to the horticulturists as well as the agriculturists; for, as it is supposed that a major portion of those who devote their time to horticulture also have farms and grow the different grains for profit, this information is applicable to you in both cases.

The collection of this information is in the hands of good observers who volunteer their time, and some not only furnish their time but also the necessary instruments; and the data, after being received at the central office, is compiled and proved and then published for the information of all who may desire to use it. The state has one of the most valuable plants for the work of any state service, and an excellent corps of observers, who freely devote time for this work, where furnished with the necessary instruments. The instruments used for the collection of the climatic data are one barometer, four thermometers (one dry, one wet, for the dew-point and humidity), one maximum and one minimum thermometer, and one rain-gauge and measuring stick. The wind is estimated from a regular scale used by all voluntary observers for this purpose. These instruments give us the same information as that furnished by the national bureau, and the observations are taken at the same hours, so that they are comparable with the standard observations, and are therefore of more value.

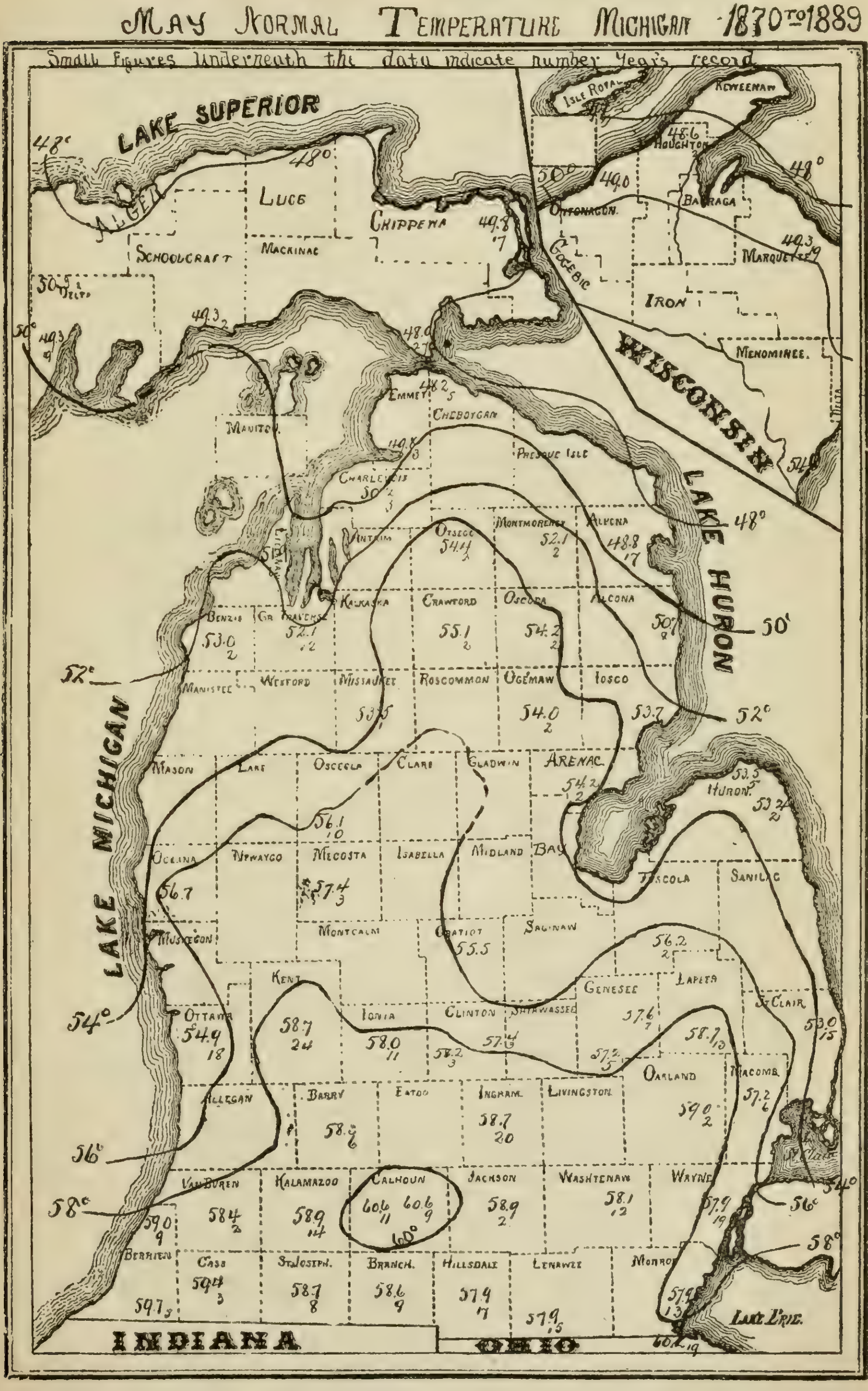
SEPTEMBER TEMPERATURE—*Chart Showing the Average Temperature of Michigan in September—How the Lakes Warm the Coasts—Curious Variations in Calhoun, Kalamazoo, and Lapeer Counties.*



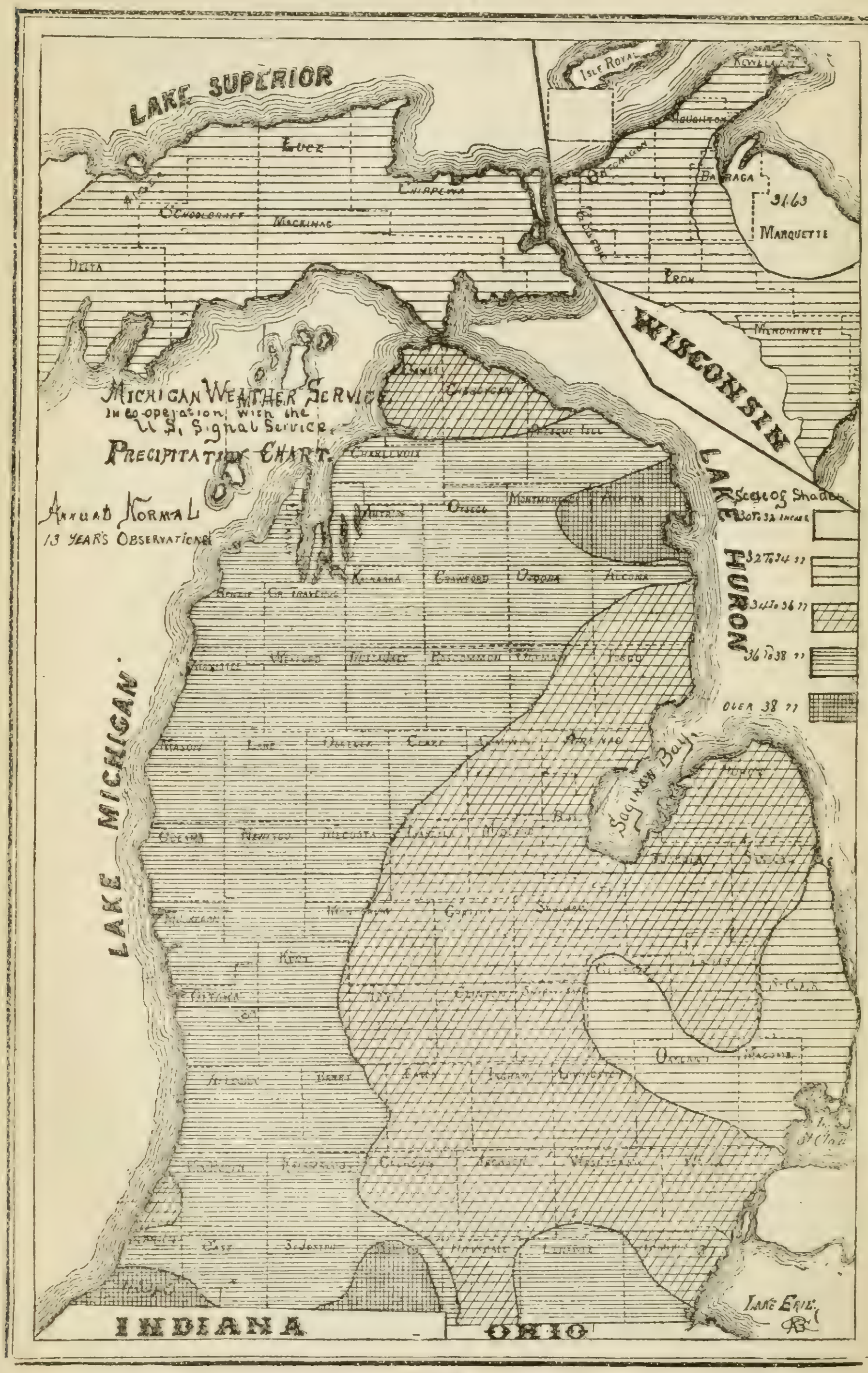
January Temperature—*Further Evidence of Lake Influence—How Lake Michigan Protects the Peach-Belt—The State's Coldest and Warmest Portions.*



THE THERMOMETER IN MAY—*Here the Lines Bend Northward—The Lakes Retard the Spring, Holding Back Vegetation Beyond Danger from Frost—Tender Fruits are thus Protected.*



MICHIGAN'S RAINFALL—*A Chart Based on Thirteen Years' Observations—How the Lake and West Winds Increase Rainfall in the West.*



We are now on the threshold of meteorology, and with the proper collection of these data there can be no doubt of the value that can be derived from the proper application of the information. First and foremost we must have the statistics, and with them we can work out the problem which will bring us many returns for the money expended in gathering the information.

Mr. L. D. WATKINS of Manchester said he was one of the eighty observers scattered over the state who make reports to Sergt. CONGER, doing the work without compensation. The record is made twice each day—at seven or eight o'clock, morning and evening. There are noted the standing of both barometer and thermometer; the state of the weather, whether fair, clear, or rainy; the degree of cloudiness, and many other such items, involving considerable work, all of which is done for nothing, and yet some of the legislators begrudge the pittance of $1,300 for office expenses for two years!

QUESTIONS OF MARKETING.

Upon the subject of marketing, Mr. H. BIRD jr., of Douglas was called out. He said there was talk in his vicinity of having central packing houses to which all fruit should be taken and sorted and packed, thereby securing uniformity, but nothing has yet become certain. There is much agitation on account of the Chicago ordinance with regard to packages, a new law requiring all fresh fruits in baskets to be sold by the bushel or aliquot parts thereof, dry measure. This would exclude the fifth-bushel baskets commonly used for peaches. But the fifth basket is not a "snide' package in any sense. It is made a full fifth of a bushel and does not purport to be more. The Saugatuck and Ganges societies have decided to send a man to Chicago to secure, if possible, acceptance of the fifth basket, which they are willing to brand and guarantee to hold a fifth of a bushel. They believe the ordinance is aimed at the cheats of repacking practiced in Chicago.

Mr. C. J. MONROE: We have had many experiences in marketing, at South Haven, and laid many plans for improved methods, but as yet have established none of them with certainty. We have studied the plan of the California union but find it not at all suitable to our case. We have also investigated those of Maryland and Delaware, but they are not exactly what we think we want. We have great difficulty in getting growers to hold together in a union for shipping. But just now a number are agreeing upon a trade-mark and an agent to look after the fruit, both in the packing houses and the market, and protect the trade-mark. He will also look up parties in the interior, to whom shipments may be made; at home he will inspect the fruit and the packing of it; in Chicago he will watch

the handling of the packages and see to shipments beyond, and care for the members' interests with commisson houses. The trade-mark will guarantee uniformity, will bear a request to report any misuse of it, and be so placed that opening the package will destroy it, making impossible its application to another package.

Mr. Bird described a similar organization at Glenn, in Ganges township, which has been highly successful in two seasons and will be in operation again this year.

Mr. Rice said there is a marked difference in size of berry boxes also. There should be a requirement of law for their marking with their true capacity.

Mr. Monroe: I am pleased to know that Benton Harbor and Douglas are both at work upon this system, for it surely hastens the time, which must come, when the three counties (Berrien, Allegan, and Van Buren) will co-operate in some such measures. It must certainly come. At South Haven we shall try to establish shipments to the interior and yet avoid gluts at any boint. For instance, one of our shippers once sent a shipment of peaches to Battle Creek. They sold well and he sent more. At this time many others had sent to the same market and all got unsatisfactory returns. So no one sent any more, and presently the Battle Creek dealers, the market being wholly without the fruit, began telegraphing for more. Some claim that gluts are beneficial to the consumer, but this instance illustrates the error of that assumption. There was one day an overstock and the next day none at all. Both shipper and consumer are best served by a constant and only a sufficient supply. Our new association will try to prevent such injurious competition as this, in the interior markets. We will guarantee the uniformity of the fruit in each package, either number one or number two, meaning to exclude all cull fruit.

Mr. Bird: The idea of a central packing house is to provide uniformity of grade and an equal chance for prices between the large and the small shipper.

Mr. Monroe: The large shippers get the better prices, because commission men desire to hold their business and because purchasers can secure from them larger quantities of fruit of uniform grade (what one man would pack as No. 1, another would put with No. 2); but this larger price is made up by the merchant from the smaller shippers. There is great need of coöperation of fruitgrowers, for a bad, diseased orchard will ruin a good orchard in the next field. So, too, growers as a whole must get good prices in order to have the business satisfactory as a whole.

WORLD'S FAIR MATTERS.

The subject of the horticultural schedules at the World's Fair was taken up, with reference to the objections made by the society, at its December meeting, to the schedules made by Prof. BLAKE and adopted by the commissioners. Prof. TAFT reported that many societies throughout the country, as well as many individual horticulturists of prominence, had joined this society in its protest. Time for action before the commissioners, in Chicago, has not arrived, but such action will be taken. He submitted schedules lately approved by Delaware fruitgrowers, made by their committee, which he regarded as the best yet proposed, and well worthy of adoption. He read the main division headings. and the matter was referred to the committee on resolutions.

Tuesday Afternoon Session.

WHAT SHALL BE DONE AT THE WORLD'S FAIR?

The first topic considered was that of Michigan's Horticultural Interests at the World's Fair. It was introduced by the following suggestions from President LYON:

Select model trees—peach, dwarf pear, and if possible cherry and plum—of bearing age; shorten their roots prior to the present spring's growth, and leave them standing till next season, taking off all fruit. In spring of '92, lift and place in suitable-size tubs or boxes; keep them in healthy condition, but remove all fruit; secure, by use of liquid manures if needful, the free formation of fruit buds. and in April or May, 1893, after cold spring storms are past, plant on Exposition grounds on plot assigned for the purpose.

Apply similar rules to as many non-bearing fruit trees and other of our hardy ornamental plants and trees, either indigenous or introduced, as funds and space will warrant, and well-grown models can be secured.

Begin this year the preparations for growing a full and satisfactory set of long-keepers to be put aside (if practicable in cold storage) to go upon the tables at the opening of the Exposition, and to be followed by small fruits as well as others, each in its season, upon the plant or on the table, either or both if practicable.

Encourage prospective exhibitors to impress their names (or initials) upon colored specimens, by shading the requisite portions from sunlight while coloring.

Maintain, by renewals when needful, as full an exhibit as practicable of our native as well as introduced wild flowers and fruits, each in its season, with their botanical and local names and the localities where obtained. The correct name should accompany all plant as well as fruit exhibits.

The preparation of an exhibit of our indigenous and introduced woods should be made, though perhaps this may be appropriately done by the Agricultural college, or by the State Forestry association.

The fruit interests of the state should also be represented by a display of both canned and desiccated exhibits, and the same is also true of its vegetable garden products.

Mr. C. J. MONROE read the following letter from Mr. JOSEPH LANNIN of South Haven, president of the West Michigan Fruitgrowers' society:

SOUTH HAVEN, March 23, 1891.

To the President and members of the State Horticultural Society:

GENTLEMEN—Being unable to attend your spring meeting, I herewith, at the request of Hon. C. J. MONROE, append a few thoughts in reference to our position, as pomologists at the coming Columbian Exposition at Chicago.

1. As Wisconsin is likely to appropriate $250,000, Montana $100,000, Minnesota $100-000 and Oregon and Washington each $100,000, Michigan should, in justice to herself, appropriate at least $175,000. Of this amount, the pomological department, because of the great fruitgrowing interest in our state, should be entitled to $20,000, to enable this branch of our industry to make a display of fruit creditable to Michigan.

2. Committees in the different branches of pomology should be appointed, with the utmost care, selecting practical men of sound judgment from the locations particularly devoted to horticultural pursuits.

3. A committee of, say five, should in my opinion be appointed, whose duty it should be to see to the arrangement of the pomological hall at our state department at Chicago.

4. In reference to committees I would recommend one on small fruit, one on apples, one on peaches, one on pears, and one on trees. By "trees" I wish to be understood as meaning a display of fruit trees in bearing. This can be accomplished by digging up young trees, two or three years old this spring, and planting them in strong boxes, which boxes can be moved to Chicago in 1893. With a little judicious management, known by practical fruitgrowers, these trees can be brought into bearing the third season from the present one.

5. Pomologists should be encouraged to propagate small fruits in boxes easy of transportation, such fruits to consist of all varieties grown in our state, from early strawberries to late grapes, inclusive, and these small fruits should be arranged and grown in the most graceful and artistic manner.

6. The West Michigan Fruitgrowers society will carefully co-operate with you in an endeavor to make a display of fruit at Chicago creditable to our state.

Respectfully,
JOSEPH LANNIN.

MR. MONROE: We should show everything in miniature. Some countries mean to show their entire topography; others will show their manufactures, their mercantile places—Venice in miniature will be at the water's edge, and Mexico will reproduce one of the Aztec cities. We should do our part as thoroughly. Prepare, the previous year, all the green fruits that can be kept over, and the dried and preserved, so as to begin in spring, and then make a continuous show of everything in the order of ripening, and, as Mr. LYON and Mr. LANNIN propose, the trees both in bearing and before bearing. As to the amount of money necessary to properly accomplish all this, the sum Mr. LANNIN proposes is larger than I had thought of, but, after all, it is no more than we could advantageously use for the whole state exhibit. Michigan people are to see the exposition cheaply, and we shall get our exhibits there cheaper than most states can, and the pride we feel in having one of our own citizens at the head of what will be the greatest fair the world ever saw, should make it of the more interest to us. If prevailing ideas are to be carried out, thirty days spent there intelligently would give better return of information than $3,000 spent in travel. No state will be represented in so many departments as Michigan. The share asked for horticulture is not too great, because our department will be of as great interest and value as any, to the whole people of the state, and with less chance of financial benefit to ourselves.

Mr. RICE thought, as to canned fruits, we should have a committee secure glass cans of some unique pattern, for our exhibit, to report at some future meeting, and get the cans into use at the preceding autumn fairs of the state and there secure fine specimens for canning.

Mr. MONROE: Each future meeting should devote more or less attention to this subject. I am glad we are to go to Port Huron for our July meeting, for we should make our work, the next two years, as broad and general as possible.

President LYON: We should look after the proper representation of horticultural interests in the appointment of commissioners. To this end, influence with the governor should be exercised by all horticulturists.

Senator TAYLOR was asked as to the condition of the bill making appropriation for the fair, and answered that, as in case of nearly all other proposed legislation, nothing had been done. The bill had merely been introduced, the amount to be appropriated being left in blank.

Mr. LYON: We should begin this present month to prepare trees, if it is to be done. So some action should be taken immediately; and necessity of action on their part should be impressed upon the state authorities.

HELPING ON EXPERIMENT STATION WORK.

"How can our society aid in desseminating the results of experiment station work?" was the next topic, and was considered by Prof. L. R. TAFT, who said there are six departments at the Agricultural college engaged in experiment work, and each of them is required to issue at least two bulletins each year. These are sent to all crop reporters, and to any others who apply or whose addresses can be learned. As to aid by this society, it is well that the secretary should copy into his Annual Report such of the bulletins as relate to horticulture, as he did do in the report of 1889, for in that way many would be reached who would not see the bulletins, and the results of the work would in that way be better preserved. Besides this, the bulletins may well be discussed in local horticultural meetings. Much of value may be found in them and much drawn out by comparison of results in the different localities.

Mr. RICE asked what is the best small pump for spraying about gardens. Prof. TAFT recommended the Lewis (made by P. C. Lewis, Catskill, N. Y.) as excellent for such purposes.

RESOLUTIONS.

The following report of the committee on resolutions was submitted and adopted:

WHEREAS, It has come to our knowledge that it is the practice of many fruitgrowers to spray their trees when in full bloom, which we believe to be a waste of time and material, and as great loss has resulted to the bee keepers by this practice; and as we recognize in the bee one of the fruitgrowers' best friends and colaborers; therefore

Resolved, That we request the legislature now in session to pass bill No. 68, file No. 3, entitled a bill to protect bees from poison, etc.

Resolved, That we ask for the continuation of the weather bureau and forestry commission.

Resolved, That the Michigan State Horticultural society endorse the classification proposed by the committee of the Peninsula (Del.) Horticultural society, for department B (Horticulture) of the Columbian Exposition, the same being practically an amplification of that proposed by the schedule committee of this society.

Resolved, That the secretary be instructed to notify the Peninsula society of this action, and also request the Michigan members of the national commission to urge its acceptance by the commission.

L. B. RICE,
H. BIRD, JR.,
E. W. ALLIS,
C. J. MONROE,
Committee.

DECLINE OF APPLE ORCHARDS.

A remark by Mr. E. W. ALLIS of Adrian, that he had read that 100 barrels of pears would take from soil as much nutriment as 100 barrels of wheat, caused a brief discussion as to the decline of apple orchards.

Mr. WATKINS expressed an opinion that apple orchards are not specially exhaustive to the soil, citing cases of extreme longevity and fruitfulness among apple trees in New Hampshire.

President LYON had heard of old Indian orchards, fruitful despite their old age, and said he thought the infertility of apple trees is due more to starvation than any other one cause, though the manner of propagation very likely has much to do with it. But such instances show that where even the natural processes of fertilization of the soil occur, the trees keep on bearing. In some such cases, however, the trees may be on soil incapable of exhaustion for some reason. But, as a rule, too much cropping of the land causes the trouble.

Mr. RICE: Often the premature decay of apple orchards is due to imperfect drainage and cold, wet subsoil. It is so in parts of my county.

Mr. BIRD: I have read that much of the trouble is due to the practice of grafting upon pieces of roots.

FINAL TOPICS.

Mr. RICE: A friend has asked me to request that writers upon new fruits shall state the kind of soil upon which they have succeeded. My Manchester strawberries are excellent upon heavy soil, but near by, on light soil, they amount to nothing.

Replying to a question, Prof. TAFT said he believed the copper solution (except eau celeste) had sufficient strength of poison to kill insects which

may drink them. A very slight mixture of Paris green with them, when spraying for apple scab or other fungi, will save the labor of one spraying for insects.

Mr. Watkins: How much shall we ask for, what percentage of the general appropriation?

Mr. Allis moved, and it was unanimously carried, that we ask for horticulture fifteen per cent. of any sum appropriated.

Adjourned sine die.

PROCEEDINGS OF THE TWENTY-FIRST ANNUAL MEETING.

HELD IN EATON RAPIDS, DEC. 1, 2, 3, 1891.

The twenty-first annual meeting of the Michigan State Horticultural society was held in Eaton Rapids, Dec. 1, 2, and 3. It was one of the largest meetings in the history of the society, the local attendance being numbered by hundreds, and that from abroad in the state and without the state being exceptionally numerous; and in point of earnest interest it has seldom been equaled. There was a large exhibit of such winter apples as only Michigan can grow: and of grapes produced by President LYON upon the grounds of the state horticultural experiment station at South Haven, and by W. F. BIRD of Ann Arbor. The sessions were held in Red-ribbon hall and all arrangements were nicely made by the local committee, Messrs. S. R. CRITTENDEN, ALBERT ROGERS, WM. P. GREEN, and ALLEN CRAWFORD.

Those who were in attendance as delegates from beyond Eaton Rapids, were in part the following:

Hon. JOHN M. SAMUELS, chief of division of horticulture, World's Columbian Exposition; A. WYCOFF of Dayton, from Ohio State Horticultural society; NELSON BOGUE, Batavia, N. Y., Western New York Horticultural society; C. A. SESSIONS and C. A. HAWLEY, Oceana county society; C. W GARFIELD, H. MAYNARD, S. M. PEARSALL, A. W. SLAYTON, Grand Rapids, and H. H. HAYES of Talmadge, Grand River Valley society; R. M. KELLOGG of Ionia; L. B. RICE of Port Huron, Sanilac county society; L. D. WATKINS, of Manchester and D. G. EDMISTON, of Adrian, Lenawee county society; H. B. DAVIS of Jackson; E. H. ROCKWOOD of Flint; A. HAMILTON of Ganges and J. F. TAYLOR of Douglas, Saugatuck and Ganges society; W. A. TAYLOR, department of agriculture, pomological division, Washington, D. C.; C. J. MONROE of South Haven, Casco and South Haven

society; N. Atwell of Lawton; J. N. Stearns of Kalamazoo; E. H. Scott, W. F. Bird, A. A. Crozier of Ann Arbor, the Washtenaw county society; R. Morrill of Benton Harbor, the Berrien county society; Prof. L R. Taft and A. G. Gulley, Michigan Agricultural college; R. H. McArdle of Homer; E. C. Reid of Allegan, the Allegan county society; H. McArdle, Fargo, N. Dakota; R. J. Coryell of Jonesville; E. Kelly of Reading; Robert L. Hewitt of Lansing, W. W. Tracy of Detroit.

The evening sessions were enlivened and made more pleasurable by vocal music by a quartet of gentlemen, Messrs. W. F. Sterling, W. D. Brainerd, G. B. Blair and Dr. W. B. Hunt, Mrs. May Perine acting as organist, and there were recitations by Miss Ada Miller of Eaton Rapids and Mrs. W. E. Oyer of Springport.

PRESIDENT'S ANNUAL ADDRESS.

The first session, that of Tuesday afternoon, December 1, was called to order by President Lyon, who asked Vice-President Garfield to take the chair, and proceeded to read the following, his annual address:

The near advent of another year brings us again together, to review the past, and invites us to gird ourselves preparatory to the duties of the incoming year, so soon to demand our attention and energies.

In other years the society, through the voluntary, unpaid efforts of a comparatively few of its self-sacrificing members and friends, derived an income from its supervision of the horticultural department of the fairs of other societies, and it to a great extent omitted the effort indispensible to the keeping up of a membership for itself. The legitimate result of this omission will appear from the circumstance that, while our membership but slightly exceeds two hundred, a neighboring society under less favorable conditions, steadily maintains a membership of not less than ten times that number, by the usual process of solicitation.

Since memberships now afford us the only ostensible present source of securing an adequate income, it seems imperative that, both for the benefit of the society and that of the public, we at once resume operations in this field, not merely at our annual meetings but at any and all our meetings as well, joining with the local society, when our session shall occur with such, and dividing the proceeds with them so far as local, annual memberships are concerned, and at the same time adding life members whenever practicable.

Some years since, the society embarked in an effort to inaugurate and maintain a system of auxiliary societies, several of which were organized and for a time effectively maintained. In some cases, however, these local organizations required to maintain them in effective condition, more of the fostering care of the parent society than it was in condition to bestow; and the advantages to be gained proving too slight to alone induce cohesion, they in some cases became disorganized.

Within the last few years, however, the establishment of the national division of pomology, and the elevation of the former commissionership of agriculture, to a dignity of a full secretaryship, making its head one of the president's confidential advisers, have developed a need of closer

affiliation between the division and the horticulturists of the country at large. To the desired end, the division (and, indeed the entire agricultural department, as well) offers, in the forms of bulletins, lectures by its experts, distributions of seeds, plants, etc., such added inducements as may suffice to insure the permanency of such local organizations. At a recent informal meeting of several members of the executive board of this society this subject was fully considered and the conviction unanimously expressed that, with these increased inducements, the society will do well to revive its former system of auxiliaries. With these remarks I leave this subject, hoping for the privilege of presenting it at large in a separate paper.

The attention of the society has heretofore been called to the need of horticultural influence and information in the upper peninsula, as well as in the newer counties of the lower peninsula. I again venture the recommendation that this subject be given careful consideration, and further suggest that it be referred to a special committee, with instructions to offer such surplus volumes as may remain on hand to such local agricultural societies, granges, or similar organizations, in counties in which there shall be no existing horticultural or pomological society, as will engage to offer the same as premiums for exhibits of a horticultural character, and to report to this society of the awards actually made, with the address of the person to whom awarded.

The exhibits heretofore made under the auspices of other societies, with the accompanying rules and regulations, have proved an efficient means of horticultural education to both observers and exhibitors. In the absence of these, there is an apparent retrograde tendency. It therefore becomes an important question how the needs of exhibitors and of the mass of fruit-growers, in this direction, can best be provided for. In many existing horticultural societies, very considerable exhibits of fruits are made at their winter meetings, with apparently an increase of attendance and interest to say nothing of the educational effect. In many cases, volunteer or special premiums are offered by business men as a matter of advertisement.

The opening of the Columbian Exposition, at Chicago, in the spring of 1893, calls for possibly important action by this society at this meeting; but, owing to the yet incomplete organization of the horticultural department of the exposition, and the lack of information upon the purposes of our state commission in the matter of a horticultural exhibit, it seems more proper to await explanation, by persons in authority, who may be expected to be in attendance here. Intimations already put forth, that all work in the preparation of a Michigan horticultural exhibit must be gratuitous, is but ill calculated to develop energy or enthusiasm, inasmuch as there will be very few if any circumstances, especially in the department of pomology, in which there can be even a hope that personal expense or effort can be made to inure to the individual.

A committee, Messrs. C. J. MONROE, C. A. SESSIONS, and JAS. F. TAYLOR, were appointed to consider the message and report upon it.

The secretary presented his annual report, as follows:

To the Michigan State Horticultural Society:

The past year has not been one of great activity on the part of the society, only one meeting having been held since the annual gathering of

1890. It was planned to hold a summer meeting at Port Huron, the date thereof being left uncertain and contingent upon the opening of the railway tunnel. This was at the request of the local committee. It was believed that the opening would occur early in June; but by that time it was as indefinite as ever, and it was determined to wait until after wheat harvest was over. Then it was found none of our "old reliables" could be present to enlighten the beginners in fruit culture, and enlightenment was what they wanted of us. The series of failures was completed by indefinate postponement on account of the nearing time of this meeting.

One year ago it was determined that the society should return to the plan of auxiliary membership of local societies, and your president and secretary were appointed a committee to carry the plan into effect. But this was based upon the new scheme of the national department of agriculture for supplying us with its publicatious, and receiving from us such information as might be desired concerning Michigan horticulture. As all this was still in an indefinite state, and has so remained until recently, nothing could be done. Now, however, we know precisely what the department has to offer and wishes to receive, and with the aid of the new standing committee upon auxiliary organizations, the matter will be immediately acted upon.

Including a balance of $253.65 on hand one year ago, the receipts of the treasury were $420.65 during this year. The expenditures were $229.67, and the balance now on hand is $190.98. The expenditures are by classes as follows:

Librarian's salary	$50 00
Expenses of executive board	31 55
Express charges on exchanges	20 35
Printing	28 25
Secretary's postage	23 47
President's office expenses	6 25
Telegrams and express charges	9 30
Expenses of treasurer's office	1 40
Proceedings (for illustrations, etc.)	14 10
Expenses of quarterly meetings	35 79
	$229 67

Thus our disbursements have not greatly outrun our receipts and the year closes with a substantial balance in the treasury.

In point of fruitfulness of orchards, vineyards, and fields, the year has been one of excess, with the exception of apples. The crop of this fruit was even less than that of last year but did not sell at as high prices, owing to better crops elsewhere; yet the market rate was such as to make growers grieve that their supply was so short. In everything else the yield was enormous, but there was demand for it all at prices either satisfactory on the whole or highly profitable to the grower. Various estimates have been made of the total value of the fruit produced and sold from the counties of the western lake shore. One of these is that the crop of Berrien, Allegan, Van Buren, and Ottawa, sold for $3,300,000. This has no basis of actual shipments from any point, and I am inclined to think it excessive; yet, as Allegan county is known to have nearly or quite 1,000,000 peach trees of bearing age, the claim that that county shipped $1,000,000 worth of peaches seems to have some foundation. Perhaps with the product of Muskegon, Oceana, and Mason counties added, an estimate of $3,000,000 as the value of the fruit crop of the lake shore would be reasonable.

It is matter of regret that no facilities are at hand for obtaining anything like a reliable estimate of the value of the fruit crop of the whole state. We shall listen with interest to the plan Mr. HEWITT shall unfold at this meeting for a betterment of this unfortunate condition.

COÖPERATION WITH THE DEPARTMENT OF AGRICULTURE.

Mr. C. W. GARFIELD of Grand Rapids: Secretary WILLITS said to me he would provide each auxiliary society five copies each of the reports and bulletins of the department, including the Agricultural Report, the Record of Experiment Stations, Journal of Mycology, monthly crop reports, the several publications concerning entomology and botany, and various others. These will be sent to the secretary of each local society, and may be distributed among the members or in whole or part kept for reference or use as a library.

Mr. L. B. RICE of Port Huron moved that this society accept the proposal of the department of agriculture. The motion was carried.

Prof. L. R. TAFT of Michigan Agricultural College: I have all these publications and value them very highly, especially the Record of Experiment Stations, and they could not fail to be of great benefit to the local societies.

President LYON: The making of fac similes in wax, of all varieties of fruits, will be of greatest importance and value especially in identification of fruits. By comparison it can readily be determined whether varieties offered as new really are so or only old sorts under new names and offered at high prices.

Mr. J. F. TAYLOR of Douglas: It seems to me that circulation of these publications, as a library, would prove impracticable; but to have them at a given place, for reference, if not enough could be had to provide one for each member, would be of the highest importance and advantage to fruitgrowers.

Mr. C. J. MONROE of South Haven: It will bring within reach of the fruitgrower information that has heretofore been gathered into large books only and has not been accessible, such things as investigation of yellows and other diseases, of injurious insects, etc. This plan will get all this information out where it is available and will be needed.

Mr. GARFIELD: There is a growing demand upon the department of agriculture for importation of new fruits, seeds, and scions, and by this plan they will be gotten out quickly and into the hands of widely separated growers, so providing for prompt tests of them under varying conditions.

TREASURER'S REPORT.

The subjoined report of Treasurer PEARSALL was read, showing the same financial condition as stated by the secretary. Messrs. L. B. RICE,

A. G. GULLEY, and S. R. FULLER were constituted a committee to examine and report upon the reports of secretary and treasurer.

EATON RAPIDS, MICH., Dec. 1, 1891.

To the Michigan State Horticultural Society:

I have the honor to present to you my annual report as treasurer:

There was in the treasury, Dec. 4, 1890	$253 65
Received during the year from annual memberships	25 00
" " " " " auxiliary societies	15 00
" " " " " interest on bonds and mortgages	127 00
	$420 65
Disbursements were as follows.	
Twenty-one checks aggregating	$229 67
Leaving a balance in the treasury of	$190 98

There are 205 life members, and the life membership fund is invested as follows:

Seymour mortgage	$1,000 00
Lytell "	300 00
Snell "	300 00
W. N. Cook "	350 00
United States bonds	100 00
	$2,050 00

All of which is submitted.

S. M. PEARSALL, *Treasurer.*

LIBRARIAN'S REPORT.

The report of THOMAS H. FORSTER, librarian, was read and adopted.

To the Executive Board and Members of the State Horticultural Society:

I have the honor to submit herewith my annual report as librarian of the State Horticultural society for the year ending Dec. 1, 1891. The following tabulated statement shows the number of our reports which have been received and distributed during the past year:

Years.	No. of books in library Dec. 1, 1890.	No. of books received during 1891.	No. of books distributed during the year.	No. of books in library Dec. 1, 1891.
1872	19		5	14
1873	1		1	
1874	2		1	1
1875	49		6	43
1876	29		1	28
1877				
1878	1			1
1879	440		6	434
1880	28		4	24
1881	721		22	699
1882	726		23	703
1883	1,891		21	1,870
1884	2,645		22	2,623
1885	1,662		21	1,641
1886	876		21	855
1887				
1888	4,292		3,220	1,072
1889	6,000		3,186	2,814

The following books have been donated to the library and received through exchanges during the year:

HORTICULTURAL REPORTS.

Ohio State Horticultural Society (1889).
Massachussetts State Horticultural Society (1889).
Iowa State Horticultural Society (1889).
Illinois State Horticultural Society (1889).
Missouri State Horticultural Society (1890).
Indiana State Horticultural Society (1889).
Illinois State Horticultural Society (1890).
Wisconsin State Horticultural Society (1890).

AGRICULTURAL REPORTS.

Kansas State Board of Agriculture (1890).
Connecticut Board of Agriculture (1890).
Maine Board of Agriculture (1890).
Agriculture of Pennsylvania (1890).

MISCELLANEOUS.

The American Association Nurserymen (1890).
Schedule of Prizes of Massachussetts Horticultural Society (1891).
Kansas State Crop Reports (1891).

Respectfully submitted,
T. H. FORSTER, *Librarian.*

The society next listened to the subjoined paper by Mr. Robert L. HEWITT of Lansing, upon

A NEW PLAN FOR GATHERING CROP STATISTICS.

"The programme says I am to read a paper on a plan for gathering horticultural statistics." This is true, but only in the sense that the lesser is always included in the greater. It is my business this afternoon to try to develop a feasible plan for collecting statistics of the productions of Michigan farms. The productions of Michigan farms include not only cereal crops, livestock, and wool, but also apples and peaches and small fruits and garden truck. Any plan for the collection of statistics of farm crops that does not include every one of these crops is defective and the statistics collected under any such plan would be incomplete.

This is an age of statistics. The honest and careful legislator is constantly referring to statistics, and making them the basis of his actions, while his dishonest or careless colleague who ignores statistics, votes upon a large percentage of legislative measures in blind ignorance. Every line of business is more or less dependent for success upon statistical data. Competition is now so intense, and the margin of profit so small, that the slightest error in calculation may lead to bankruptcy. Hence it should occasion no surprise that the intelligent business man exhausts every resource to make himself fully acquainted with all facts relating to his business. True and accurate statistics are a compilation of facts, and are usually presented in tabular form. Such facts, presented, in such form, are what the business man is seeking, what he must have.

The business man has little interest in theories. He may at times be entertained by them, he may even receive valuable suggestions from them, but he bases his actions on solid facts, whenever such are to be obtained. In all commercial transactions the most important facts are those relating

to the supply and demand. Though it may sometimes seem that the law has been abrogated, yet prices today, as they always have been, are controlled by the inexorable law of supply and demand. If the supply exceeds the demand, the price will certainly rule low; on the other hand, if there is a deficiency in the supply, the price will rule high. And it should be borne in mind that a fictitious oversupply or a fictitious deficiency influences prices precisely as does real oversupply or deficiency. He who offers to sell fifty millions of wheat for future delivery, though he does not expect, or any one else expect, that he will ever actually deliver a bushel, is nevertheless as potent a factor in breaking the market as the legitimate merchant who offers fifty millions of the real stuff.

All enlightened nations of the earth are today trying to determine the amount of bread crops available. And year by year the expenditure in this direction is greater and greater. England, France, Germany, and Austria-Hungary of the European world, have for years furnished more or less accurate statistics. And even Russia has, since 1865, been developing a crop reporting system. This country's present system was first put into practice in 1883. It is under official control, having been authorized by the emperor himself. A brief account of the Russian system may be found in the September report of the U. S. department of agriculture. The subject of accurate statistics of bread food is considered so vitally important in Europe that for many years representatives of the several wheat-growing countries have annually met in the Austrian capital, in what is popularly known as the Vienna congress, and after carefully surveying the whole wheat-growing world have prepared and published an estimate of the world's wheat crop of the current year.

The system of our own United States department of agriculture is too well understood to require special description. It is a huge machine, yet Mr. Dodge seems to have it well in hand. It has in late years been greatly improved, and the work being done by the statistical division of the department of agriculture is of incalculable value to the producers and consumers—it is of no value to the speculator. It is only three or four years since, in the national convention of the boards of trade, a resolution was introduced, recommending that the department be abolished. I have no sympathy, hardly patience, with the claim so often made that the national crop statistics are compiled in the interest and for the benefit of boards of trade. The truth is, and a candid and impartial investigation will show, that the statistician at Washington fearlessly publishes what the returns show to be facts, regardless of consequences. If the wheat crop is immense, as it is this year, the truth is not withheld even if the price should go lower than the producer thinks; while if the crop be small the dealer is not spared.

But I would not have you think that I regard the national crop reporting system as perfect, or even the best that could be devised at the present time. I shall expect it to be much improved in the near future.

Besides the reports issued under national authority, several of the states have for a number of years published, more or less frequently, state crop reports. These have been prepared under a system in many respects similar and in other respects very unlike the national system. The points of similarity are that the condition of crops when still growing, and of livestock, is reported in percentages of a full crop or a full average; the points of difference are that many of the state reports are corrected each year by an actual farm-to-farm canvasser, while the national reports are so

corrected only once in ten years, or at the taking of the U. S. census. This without doubt gives the state report an advantage that can not be overestimated. Michigan is one of the states that is publishing crop reports. The system here must be by this time pretty well understood. Briefly, there is a corps of correspondents throughout the state who report from month to month the condition of growing crops and of livestock, and at the close of the harvest the out-turn of the crops. In addition to this the supervisors make a farm-to-farm canvass each spring at the time of taking the assessment, and report the acres and yield of the crops of the preceding year, and the acres in wheat, and the number of each class of livestock at the time of taking the assessment. These statistics furnished by supervisors form the basis of the monthly estimates made by crop correspondents.

This compound system, if it may be so termed, was started as an experiment, and has never been deemed to be perfect. The most claimed for it at its inception was that it was the best that could then be devised. Experience having brought to view some of its defects, it now remains for the people to correct them. What are some of the defects?

First to be named is the fact that the annual farm statistics are taken by assessing officers. As a class I do not believe more honest or faithful men can be found anywhere than are the supervisors in this state. They are competent and do the best they can. But they are chosen for another and well-defined purpose, viz.: the listing and valuing of property for taxation. That of itself is as much as ought to be required of any man at one time. In this connection it should be noted that when an assessing officer collects statistics of products it quite frequently is the case that the mind of the man assessed somehow connects the statistics with the assessment, to the detriment of the statistics. The assessed fears that a full and honest report of his crops will add to his taxes.

Again, the assessment is made too early in the spring. It is usually begun immediately after the first Monday in April. At this time spring crops are not planted, and the growing wheat and the fruit buds are not yet in such condition that a report of value can be made respecting them.

The last defect we will now notice is that the supervisor, being crowded with work, has no time to foot his report. All reports have to be footed in the office of the secretary of state. This throws upon eight or ten clerks the work that might be done by about 1,200 men, and of course the publication of the statistics is thereby greatly delayed. Now, as a better system, I would propose: First, that the office of local statistician be appointed in every township and assessment district in the state. He should hold the office so long as he faithfully performed his duties. It should be his duty to collect the farm statistics, and I would add also the statistics of births and the statistics of the defective classes—the insane, deaf and dumb, blind, epileptic, etc., all of which are now collected by the supervisors. He should also be the crop correspondent for his township or district.

The canvass of the town for the collection of statistics should be made the last week in May and the first week in June. The farm statistics, as soon as the canvass is completed, should be footed by the local statistician and forwarded to the secretary of state at Lansing. The statistician should retain a duplicate copy. This is the proposed system, and the whole of it. It could be improved by requiring the statistician, at the time of making the canvass of his township or district, to leave with each

family a blank on which the farmer should note the amount of his farm, fruit, and market garden productions; these blanks so distributed to be taken up by the statistician in a second canvass, late in the season, say the first week in December, the totals copied in another blank, footed, and the blank sent to the secretary of state. This it will be noticed would give the complete statistics to the public at least six months earlier than by the system proposed. It is probable that objections to a plan involving the distribution of "prior schedules" and a second canvass of the township each year would make it impracticable at the present time, but sometime in the future this will be the favorite plan.

Now, what are the advantages of the proposed system? It seems that it would correct all the present system. First, it takes the statistics out of the hands of the assessing officer, it leaves him unhampered by duties that are wholly foreign to those he is elected especially to perform, and it leaves no excuse for anyone to refuse to give a true statement of his crops lest taxes should be thereby increased.

Second, the farm statistics, being collected at the date named, could include in addition to the data now reported, the area planted to spring crops as well as the area sown to wheat, the area of wheat plowed up because winter-killed or otherwise destroyed, the number of sheep and pounds of wool sheared, the area of bearing orchards, vineyards, berry fields, and in market garden crops, the present condition of wheat and spring crops, and of all kinds of fruit. This it will be seen would furnish the best basis possible for estimates during the next three months of the probable out-turn of the season's crops.

The advantages of having the acreage in the several crops accurately reported, can not be too strongly emphasized. During the growing season the condition of the crops can only be estimated. Nothing better is possible. These estimates are the expression of the reporter's best judgment, and may, and often do come wide of the mark. If in addition, the reporters are required to estimate the acreage, the chances for error in statement of probable final output are greatly increased.

Again, holding the office for a long series of years, the statistician would acquire an expertness impossible to the supervisor, who is elected annually and in too many cases changed annually. The statistician would soon become well acquainted with every farm and every farmer in the township. It is obvious this would greatly aid him in preparing his reports. He could make them more quickly and more accurately each succeeding year.

The statistician should foot his report before sending it to Lansing. This would complete in a part of a single day, work that now requires weeks of time in the office of the secretary of state. Complaint is often made that under the present system the publication of the reports is so long delayed as to deprive them of much of their value. Under the proposed system there should be no occasion for such complaint. The saving of time in the secretary's office would of course result in a corresponding reduction of expenses.

One point of great value to the state should not be overlooked, though perhaps of no consequence to the crop reporting system. The local statisticians could be utilized in census years by making them census enumerators. Their experience in statistical methods and consequent expertness would enable them to canvass their township or district in less time and do their work far better, than is possible for inexperienced enumera-

tors. These officers, acting as census enumerators, could do much of the first work in compilation, such as footing the columns in their reports. This, as in the case of the farm statistics under the proposed system, would equal and would, I believe, shorten the work of compilation in the secretary of state's office when only a few clerks can be employed, by at least one half.

What are some of the objections to such a system?

First, It creates a new office. The people are, on general principles, opposed to any scheme that lengthens the list of public officials. In reply it may as well be admitted first as last that until perfection is reached in all matters pertaining to government, the body of public officials will continue to grow. The facts that are today affecting in various ways the welfare of the people, about which we ought to have perfect knowledge, but really have very little or no knowledge at all, are almost countless. One by one subjects of great importance come to the front and new offices are created. It is within the memory of many now here that the insurance bureau, the state board of health, the state board of charities, the bureau of labor, and the offices of the commissioner of railroads and commissioner of banking were created. We now have a fish commissioner, a state game warden, and a large number of oil inspectors. The time was when none of these were necessary; now they are indispensable. The real question to be decided is, are accurate statistics of our various farm productions of sufficient importance to warrant the adoption of the plan here proposed? If ever adopted it will be for the benefit of the producers and consumers. This fact should be kept in mind. Hence I repeat, it will be for the benefit of the producers and consumers. The dealers will take care of themselves. They know the value of such statistics to their business and they spare neither pains nor expense to secure them. Writing of the 1891 wheat crop, the secretary of the Detroit board of trade, in July last, said: "Our grain merchants have never been more painstaking and careful in collecting information relative to the yield of the crop than for that of the present year. Representatives have traveled over the state and letters almost without number have been received from local correspondents relative to the outlook for the harvest. If boards of trade can and do go to this great trouble and expense to secure statistics to form the basis of their business, it can not be that the great body of producers and consumers will not approve a plan that will secure to them also like information. The dealers expend more in trying to secure statistics of the wheat crop than of any other, yet other crops are investigated and reported upon, each according to its importance.

The question of cost is the second likely to be asked. The local statistician should receive the same per diem compensation as the supervisor. But this I do not believe would make the expense greater than now. The time required to take the assessment is now prolonged because the supervisor takes the statistics it is here proposed to place in the hands of the local statisticians. The supervisor takes the statistics while taking the assessment. The local statisticians will have to make a trip over the town ship for that purpose. The time required to make this trip over the township is the only additional labor contemplated. A township of thirty-six sections, with a road around and residences on all sides of each section, contains eighty-four miles of highway that the statisticians would have to traverse. The time required to travel these eighty-four miles measures the possible extra cost under the plan proposed. But the statistician

remaining, as proposed, permanently in office, would certainly acquire a knowledge of the township and expertness in collecting statistical data, that would more than offset this slight additional expense. The first year of trial, the expense might be somewhat greater than under the present system, but not afterward.

You are doubtless by this time asking, By whom shall the local statisticians be appointed? In answer, the law establishing the system should provide that crop correspondents who will accept appointment shall be the local statisticians. The list of correspondents in this state contains the names of a large number of men who have for years served the state almost gratuitiously. The state should avail itself of the experience in statistical work these men have acquired; besides, it is only justice that they be given the preference. In townships where there are no correspondents the township board should appoint the statistician.

In 1884, census enumerators were appointed by township boards. The promptness and accuracy with which the census of that year was taken proves that the boards were careful in making the appointments. The mistakes in enumeration were in the main due to inexperience. It may be assumed that township boards would exercise no less care in the selection of local statisticians. But the statistician once appointed should in no case be removed without the consent of the secretary of state, and his consent should never be given except for neglect of duty or manifest incompetence. This will insure permanence in office, which is one of the principal advantages to be gained under the proposed system."

A DISCUSSION OF THE MATTER.

Mr. HEWITT added that the local statistician should leave with each farmer a crop report blank, in June, and call for it in December, but he fears the people are scarcely yet ready for this provision.

Called upon by the chair to give his opinion of the paper, to question Mr. HEWITT upon it, Mr. L. B. RICE of Port Huron said, "It is so clear that we do not need ask questions. There is nothing left to ask."

Mr. R. MORRILL of Benton Harbor asked Mr. HEWITT to supplement the paper with an estimate of the cost of carrying its provisions into effect.

Mr. HEWITT: I have made none. But it would require 84 miles of travel by the statistician of each township. I do not know how much time the supervisor requires to do his annual work in connection with his assessment, but probably the taking of the statistics occupies half of that time.

Mr. MORRILL: Say $50 per township.

Wm. HALE, supervisor of Eaton Rapids township: It requires from fifteen to twenty-five days' time to take the assessment and statistics, and about half the time for statistics.

Mr. HEWITT: That would be $20 to $25 as the maximum of cost; and

after the statistician's first year he would do the work quicker than would the supervisor.

Mr. HEWITT gave a history of the legislation which provided for crop reports and making of farm statistics, and asked that this society by resolution begin the work of securing adoption of this new and better method, and push it to completion.

A member asked, "Where would the advantage to the producer come in? He would not get the reports before January, and by that time the speculator would have completed all his schemes for control of crops and prices.

Mr. HEWITT: The statistics would be supplementary to the regular crop reports. We get the acreage early in the season and report upon the condition and average yield month by month. The sooner the statistics are gathered, the more accurate they will be. The farmers forget, as a rule, the amount of all but their main crops, such as wheat.

Mr. MORRILL: The result to the producer will be much or little, as he chooses to make it. Societies are forming everywhere to secure such information, and this would be only a part of the chain embracing the whole.

Mr. C. A. HAWLEY of Shelby: I learn, by the papers I take, the state of the crops, and base my prices for sales upon it. All such information is of value to the producer if he chooses to make it so.

Mr. MORRILL: Even late statistics are often of value. I recently received from the agricultural department a report of crop yields, by states, last year. By it I learned that Michigan grows two bushels of potatoes to one of Dakota, upon equal acreage, and gets $2 to Dakota's $1 for the amount of farm produce sold. Many such other revelations as this cured me of an attack of "western fever" I had. I found Michigan unsurpassed as to yield and cash product, acre for acre.

Mr. GARFIELD: The supervisor has not time to properly collect the farm statistics, and his heart is not in the work. The statistician would not be so, for collection of the statistics would be his primary duty.

Mr. R. M. KELLOGG of Ionia: Farmers have a prejudice against collection of statistics by the supervisor. They believe the results given will in some way affect their assessment and be used for the benefit of speculators.

Mr. KELLOGG moved that it be declared to be the sense of this meeting that township statisticians should be appointed to do the work of collecting statistics as proposed by Mr. HEWITT. The motion was unanimously carried.

DELEGATES TO OTHER MEETINGS.

Mr. L. B. RICE of Port Huron was chosen as a delegate to represent this society at the annual meeting, at Hamilton, of the Ontario Fruitgrowers' association; and Mr. A. G. GULLEY to that of the Western New York Horticultural society, each being authorized to appoint others whom they may find desirous of accompanying them.

THE AUXILIARY SYSTEM READOPTED.

Mr. GARFIELD submitted the following report from the committee on auxiliary societies, which was adopted:

The standing committee on auxiliary organizations desires to express its satisfaction with the action of the society in accepting the proposition of the department of agriculture, made by Assistant Secretary WILLITS, which provides for a more intimate relationship between the government bureaus of pomology, horticulture, and scientific departments allied thereto, and the local and district horticultural societies of our state, through the agency of our society. In order to make this arrangement in the highest degree available, it becomes necessary at once to place ourselves in intimate relationship with every local and district society in the state. Thus, while accepting the agency of the department of agriculture, we shall be a reliable, well-equipped, and authoritative representative of the horticultural organizations of the state.

To this end we recommend, (1) that this society once more adopt the system of auxiliary relationship between the state and local horticultural societies, and the by-laws that govern that relationship; (2) that a letter be sent to each local and district organization devoted wholly or in part to horticulture, embodying in its text a full statement of the advantages that will accrue from such relationship and the further connection with the department of agriculture, as well as the pledges of this society to co-operate in every possible way with such societies for mutual advantage; (3) that the same letter be sent to each locality in which a society of this character may have some time existed, with suggestions for reorganization; (4) that an effort be made in new localities to awaken an interest in this scheme and thus add to the means of usefulness of our society.

Your committee, while presenting this view and asking your adoption of this plan, solicit suggestions as to the most promising methods to pursue in the accomplishment of the purpose for which the above report has been written.

CHAS. W. GARFIELD,
R. MORRILL,
L. D. WATKINS,
Committee.

The president announced the following committees and the meeting adjourned till evening:

Resolutions—Messrs. J. F. TAYLOR, C. A. HAWLEY and L. R. TAFT.
Delegates—Messrs. R. MORRILL, R. M. KELLOGG and ARTHUR P. GREEN.
Exhibits—Messrs. A. G. GULLEY, C. A. SESSIONS and H. B. DAVIS.

Tuesday Evening Session.

The opening number of the programme was an excellent vocal selection by a quartet of gentlemen, who on several occasions afterward placed the assemblage under like obligations. This was followed by an address of welcome by Rev. J. P. FARMER, to which Mr. C. W. GARFIELD made fitting response. Miss ADA MILLER of Eaton Rapids gave a recitation, appropri-

ate in subject and excellent in rendition. Next came the subjoined paper by Mr. ALLEN CRAWFORD of Eaton Rapids, upon

PRESENT STATE OF HORTICULTURE IN EATON COUNTY.

A lack of time and experience for this kind of work, I fear, will render what I have jotted down of little interest to so able a company of horticulturists as are with us here tonight; but as something must be said in answer to the question, what is the present state of horticulture in Eaton county, I will try to give such information as could be gleaned from the leading fruitgrowers and buyers. I have observed that it is a matter of general belief with our citizens that Eaton county is an excellent county for production of some kinds of fruit—apples, pears, plums, cherries, and some of the small fruits. We are without proximity to any large body of water to soften our climate, or any notable elevations in our land, that might assist in securing exemption from frosts; still, somehow, this notion has been impressed upon our minds. Perhaps it is only our selfish regard for our home interests; or possibly it may be the work of the buyers of our fruit, who, while patting us on our backs, are dosing us with this kind of "taffy" to keep us from noticing the extra peck of apples they are piling upon the barrels.

But we believe we are justified in claiming for Eaton county, over its adjoining counties, a superiority in at least the production of large quantities of choice apples and the finest quality of maple sugar and syrup produced in the state. Residents of the county have taken samples of their fruit to the annual state fair and been unusually successful in securing a a large amount of the premium money. This year Messrs. Arthur GREEN of Eaton Rapids and F. H. PARKER of Hamlin township exhibited fruit at the state fair and were paid $132.50 in premiums. Mr. Arthur GREEN afterward took his collection to Grand Rapids and there secured $58 more; losing $30 from failure to comply with the rules for number of plates.

Our citizens have viewed with pride the horticultural productions exhibited at the fairs held this past season in the county. The interest in fruitgrowing was brought to this county by those early pioneer men and women coming here from their York state and New England homes, along in the earlier years of the settlement of the county. It so happened that some of these men were well fitted by education and inclination to commence in the business of growing fruit trees. Several nurseries were early started in the county, in which the selection and propagation of choice and profitable varieties of fruit had much influence in placing us forward in fruit culture. The early settlers saw this land covered with large and dense growths of timber, knowing that this heavy production of timber indicated a soil, strong, deep and rich, they did not hesitate to plant orchards as soon as suitable land could be cleared. The planting and growing since of these fruit trees, in the soil and climate that first gave them root and branch, we think was an important factor in their future hardiness and fruitfulness. These first orchards where properly cared for are still as fruitful and vigorous of growth as many set in later years.

Then, again, in those early days this timber was a sure windbreak; and even now that remaining hinders the cold sweep of winter and the whipping gusts of fall that rob our exposed trees of so much of their fruit. Our strong soil is less influenced by the exhausting hot weather of

summer, or the severe, deep freezing of winter, than those of a lighter mold. Other equally as good reasons might be stated in substantiation for the faith that is within us, of what I have said in our praise as an interior fruit county.

In a year when our orchards have only produced one third of an average yield of fruit, it would appear like an inappropriate time to ask the question, What is the condition of horticulture in this county? One year and two years ago, the apple crop was simply immense—especially two years ago beyond all precedent. In answer, then, we should have pointed you to the farmers' teams that filled our streets, from early morn till late at night, with loads of apples in barrels, for export, wagon-box loads for packing and for the two large evaporators here; and for cider and vinegar, carloard after carload was shipped away. In the year 1889, the First National bank of Eaton Rapids paid over its counters, for the apple buyers of this city, the large sum of $125,000 for apples and help to care for them. Last year, 1890, the crop of apples was not up in quantity with the year before, but the price was better, and this same bank paid checks of our fruit-buyers here to an amount of over $95,000. Other portions of our county have had large yields and returns from their apple orchards but this "Island City" has been the largest and best market of any point within the county, and has drawn hither the fruit of many growers from very near other markets.

Now, when I come to the present year, 1891, and tell you our buyers gave us but little more than one half the former price, and the crop was but one third in yield, you will realize the diffidence I feel in stating the amount disbursed at this point to be, in round numbers, $28,000 for the fruit, the packages, and labor of putting up and handling. Our farmers have been, perhaps, derelict in the years past in the care of their orchards. Help has been scarce and dear; the farmers' sons are leaving the farm; they feel that other classes of people are doing better financially; that even legislation is so shaped that they can not stay on the farm and so well secure the comforts and luxuries for themselves and a family as to live where they set the price for both sides of a trade. And so, with a scarcity of interested help, and more work than the farmer can do properly, it is our belief that on very many of our heretofore first-class fruit farms, they are letting their orchards go without proper pruning, mulching, and cultivation. Still, there are considerable quantities of all kinds of fruit trees set in our county every year. Especially are small fruits set for city consumers. A few individuals, near the cities and villages in the county, are making it a special branch of business to raise strawberries, raspberries, cherries, plums, pears, and grapes to an extent almost if not quite to supply the local demands within the county. Near Charlotte, one man, L. R. FREEMAN, has twenty-two acres largely set to small fruits within the past three years. Another, Mr. SHAW, has five acres set to small fruits, pears, and plums. Others are doing something in a small way about there.

In this vicinity there have been planted within the past two seasons, 120 acres of raspberries, the Ohio variety, under contract with J. C. SELBY, it being his intention to dry the product in his evaporator here. The past year he expended about $1,000 in setting out, culture, rental, and picking fruit, etc., and received some $450 for the fruit product. F. H. PARKER has seven acres of market raspberries, and in addition a regular fruit garden of choice varieties of grapes, pears, peaches, plums, strawberries, and an apple orchard of which 500 trees are the Ben Davis, lately

set. S. R. Fuller has a vineyard of the Niagara grape, and in connection, strawberries and a market garden. Others are engaged in less degree in small and choice fruits and vegetables. Quite a number of small farmers are raising small fruits and garden truck where they have the right kind of soil and skill to make it a success. They sell much of their produce to the larger farmers who think their time more valuable in raising stock and grain than in growing berries and "garden sauce."

Daniel Strange, near Grand Ledge, has probably the largest apple orchard in Eaton county, having set for market, a few years ago, 1,600 trees of the Ben Davis variety, which are just now coming into bearing. Next to him, Mr. Wm. P. Green, near this city, has some 1,500 trees of choice varieties, largely of his own selection and raising. Mr. Wilton of Kalamo township has a large orchard which he sprayed the past season. He sold 346 barrels of first quality fruit. But few others sprayed trees in that vicinity, and the apple crop, with those who neglected this precaution, was nearly a failure.

At Charlotte there were packed for market about 4,000 barrels of apples, just about one third of last season's crop. There were a good many fruit trees set last spring, but "farmers neglect them" is the talk of the fruit buyer. It is very probable, the statistics gathered by the supervisors to the contrary notwithstanding, that there is every year more fruit trees set, that live to bear fruit, than are destroyed or become barren, of the aged bearing trees.

I think this little society, known as the Eaton County Horticultural society, by its precept and example, has been of much influence in keeping up and encouraging the fruitgrower in this locality. Holding monthly meetings, from house to house of its members, exchanging inquiries and experiences, often addressed by professors from the Agricultural college and other learned and skilled men in horticulture, it has been the means of enlightening all who came within its influence, as to the best varieties of fruit and vegetable for cultivation, also as to the proper method of fighting that vast army of destroying insects and worms that now infest every garden and orchard. We believe there has been more spraying outfits sold and used in and about this immediate vicinity than in all the rest of the county; that here the production of fruit has been the largest, fairest, and best; that the fruit has brought the producer more money for his labor, and thereby profit, than where this society's example and practice did not extend.

Eaton county has always been noted for its fine quality of maple sugar and syrup. Last spring, under the inducement of the two cents per pound government bounty on manufactured maple sugar, thirty-two farmers in the county each bought a Williams evaporator and went largely into making sugar and syrup. Although but two or three will comply with all the red-tape regulations necessary to get the bounty, still, in consequence of that inducement, all have exerted themselves and have made their maple trees the most paying property they have, several getting five, six, and seven hundred dollars for the season's run, some of these maple tree orchards yielding in sugar and syrup one-half dollar per tree. One firm in Charlotte, J. Mikesell & Co., bought 1,400 gallons of this maple syrup, and largely of sugar, to refine and purify and sell again to their customers. A man that had much highway on his farm might set out quite a respectable sugar-bush by the roadside, and his children or somebody's else children would have a chance to make sugar in about thirty

years from setting out, or what would be still better, set apple trees, and in a few years their fruit would buy all the sugar and syrup needed, and money be left for other purposes.

Other and abler pens than mine have from time to time given you the history and statistics of horticulture in this county, so that much that I can say is only a rethreshing of old straw. This paper is becoming somewhat lengthy and tedious; still I would call your attention to an item or two more. I find, by the state census of 1874, Eaton county is reported as having 6,934 acres of orchards, later, by the state census of 1884, it is reported at 6,312.50 acres of apple orchard, a loss under state census, in 10 years, of 622 acres, a loss of nine per cent. for the period. I also find the supervisors' report for the year 1889 to credit Eaton county with having 6,447.20 acres of apple orchard; and the following year, 1890, the same is reported at 5,931.54 acres, a loss in one year of 516 acres, fully eight per cent. Now, it is possible that during the ten years between the taking of the state's census, this waste and destruction of orchards may have happened. We can think of natural causes and circumstances occuring near that time to bring about such a result. But I am sure, if our supervisors had taken their census correctly, for the two years past there would be no such difference as they have given us in their reports. If we were to judge of the state of horticulture in Eaton county by the state census and supervisors' reports, we should be obliged to state that fruit-raising was rapidly becoming one of the industries of the past. Such we do not believe to be the case, but that, for the past few years, more trees are set in orchards, that grow to bear fruit, than die out of the old trees.

Nothing has been done toward the preservation of the forest trees, neither have our people set out trees for future timber uses so far as I have been able to learn. It seems as though there should be, in some way, a government aid or bounty given that man who would reset to timber some of the waste places in our county, that are now so desolate and worthless. Surely he should deserve as well, or better, for such service as the man who makes more out of his sugar bush than from all the rest of his farm lands, bounty or no bounty.

Mr. Rice: It has been observed in New York that such roadside trees as Mr. Crawford speaks of, which are quite common there, often bear better than those further away in adjoining fields, and the cause of this is believed to be the fertilizing qualities of road dust.

Mr. Crawford: Besides the aid of the dust, the trees have the advantage that the soil they stand in is not cropped.

Next in order came the following paper by Prof. L. R. Taft of Michigan Agricultural college, upon the process of fertilization of flowers, entitled

FROM BLOSSOM TO FRUIT.

We all admire beautiful or fragrant flowers, and perhaps sometimes think that they have been giving their bright colors and pleasant odors that they may contribute to the gratification of our senses; but, really, in the wild flowers with which nature surrounds us with so lavish a hand, it is doubtful if this is at best more than a secondary object.

Nearly all of our higher plants, at some period of their existence, are

capable of producing flowers. It is true that they may be small and insignificant, unattractive in form, color, or odor, and in fact lacking in all that, to the popular mind, goes to make up a flower, but to the botanist they possess the organs requisite to make them flowers. They may be developed on the ends of the stems or branches, on short stalks, in the axils of the leaves, on the leaves themselves, or even in the ground. Those forming under ground do not open, and bear little resemblance to flowers. If we take our common flowers and examine them, we shall find them composed of four parts, two of which, either separately or together, are really all that are necessary or essential to make up a flower. The other parts are mainly useful to protect the inner organs. Beginning at the center we find one or more pistils, which are surrounded by a row of stamens; next comes the inner row of covering organs, known as petals, which together form what is called the corolla, and last of all the sepals make up the outer row or calyx. This is usually green in color and may be in separate parts, like narrow pointed leaves (Fig. 1, *a*) or they may be

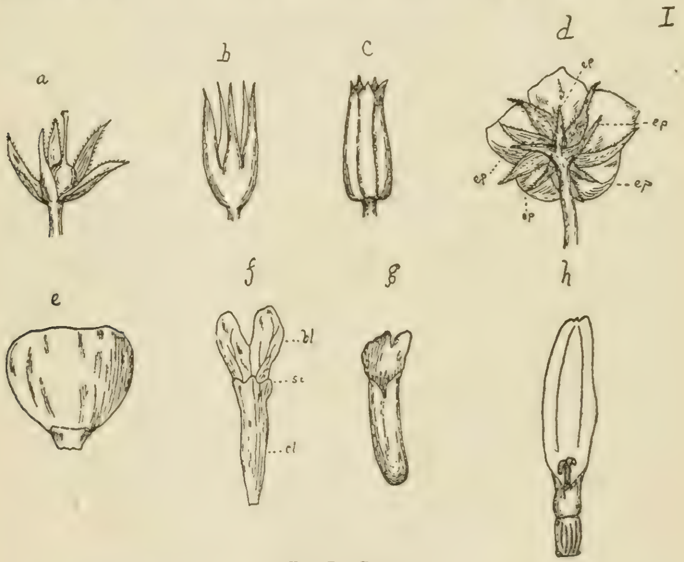


FIG. I.—CALYX.

a, Calyx distinct—*Loosestrife*.
b, Calyx united part way—*Erythraea*.
c, Calyx tubular—*Bouncing Bet*.
d, Calyx distinct with epicalyx or calycule, (*e. p.*)—*Strawberry*.

COROLLA.

e, Petal of Crowfoot, with scale at base.
f, Petal of Cockle; *bl*, blade; *sc*, scale; *cl*, claw.
g, Petal of Hellebore, tubular.
h, Ligulate corolla—*Chrysanthemum*.

fastened together at their edges, forming a sort of tube or cup (Fig. I, *b*, *c*). The petals are usually of some bright color and may be grown together (Fig. I, *f*, *g*) or may be entirely separate. (Fig. I, *e*.) The number of petals may be very great, as in the case of double flowers, where the stamens have been transformed into petals. In some cases the petals are entirely wanting, when the sepals take their place and have some bright color. In a few flowers, both sepals and petals are wanting, as, for example, in the calla and cat-tail.

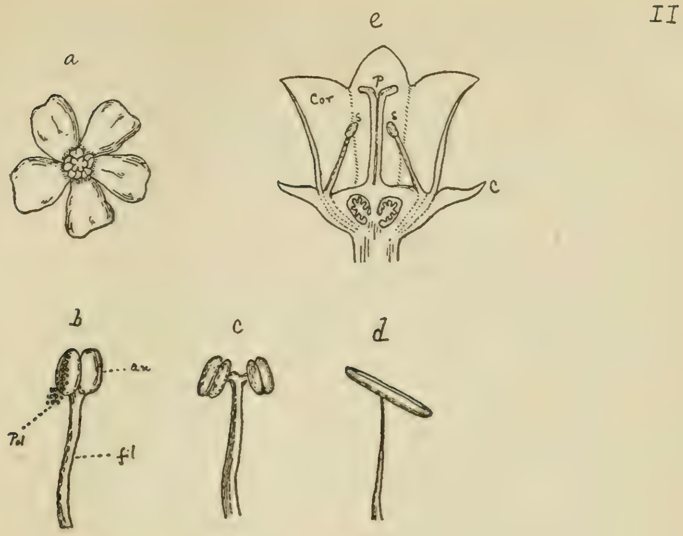


FIG. II.

II. *a.* Myosotis. Flower with closed corolla.
b. Stamen. Onion, *an*, anther; *pol*, pollen; *fil*, filament
c. Stamen. Lime.
d. Stamen Colchicum.
e. Diagrammatic section of a flower of the Foxglove. *C*, calyx; *cor* corolla; *s*, stamen; *p*, pistil.
The dotted lines show where the various parts are united to each other.

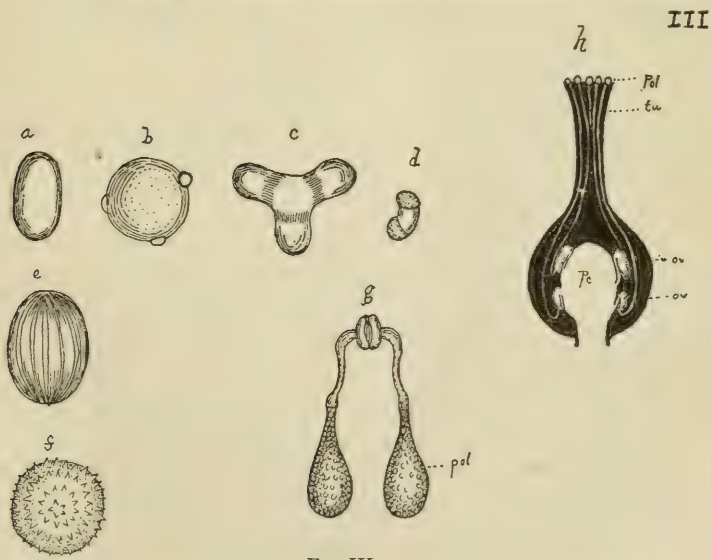


FIG. III.

a-f. *Pollen grains.* *a*, lily; *b*, cherry; *c*, evening primrose; *d*, pine; *e*, polygola; *f*, hollyhock. All greatly enlarged.
g. Pollinia of Milkweed, the pollen being united in wax-like masses.
h. Section of a pistil showing fertilization of the ovules, *pol.* pollen; *tu*, pollen tubes; *ov*, ovules; *pc*, placenta.

The pistil is (Fig. IV, *a, b, c, e*) generally an elongated organ with a swelling at the lower end, known as the ovary, which may contain a single chamber or it may be divided into from two to many cells. These chambers contain the ovules which develop into seeds. (Fig. IV, *b, f, g.*) The upper portion of the pistil lacks any epidermal covering, and is known as the stigma. This is covered with a sticky substance, and, unless it is situated on the ovary itself, it is connected with it by a slender filament. the style.

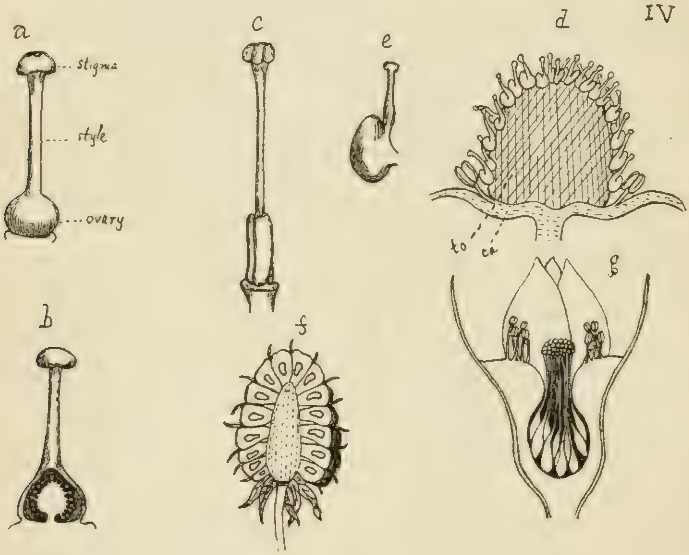


Fig. IV.

a, Pistil of primrose.
b, Same with part of ovary cut away showing the ovules attached to the free central placenta.
c, Pistil of lily.
d, Section of strawberry showing the pistils attached to the fleshy torus, *to ca*, Calyx.
e, Single pistil of same, enlarged.
f, Section of raspberry.
g, Section of a rose flower.

The other essential organs are known as stamens (Fig. II, *b. c, d*) and consist of two parts, a slender stalk or stem, called the filament, and a knob at the top, the anther.

Many flowers contain both stamens and pistils. and are then said to be perfect; but in other cases we find the stamens and pistils in different flowers, on the same plant, or perhaps on different plants.

The anther is usually in two parts, and its function is to develop in its cells a fine, yellow dust known as pollen (Fig. II., *b*). These grains are very minute and are produced in great abundance. Every farmer has seen the fine, dust-like grains covering the ground in his corn fields, and in some of our pine forests it is produced in such quantities that it is carried miles by the wind and falls like snow in a storm.

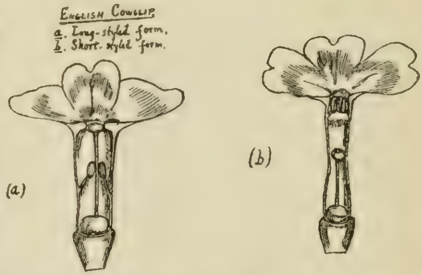
The pollen grains (Fig. III., *a-g*) are generally round or elliptical, but in some species they are covered with spines, in others they are grooved, or they may be compound, with two or more fastened together.

The function of the pollen is to fertilize the ovules in the pistil, that they may develop and form seeds. It consists of a mass of gelatinous substance known as protoplasm, and is surrounded with two cell walls.

When fully developed, the walls of the anthers burst and the pollen grains escape. If brought into contact with the stigmatic surface they at once send out pollen tubes (Fig. III, *h*), as they are called, which work their way down through the tissues of the style and penetrate the ovules. The nucleus unites with the nucleus of the ovule, and the act of fertilization is accomplished.

Having considered the structure of the flowers, and the functions of the different organs, let us stop for a moment and ascertain how these parts have been formed. By the botanist the four parts that go to make up a complete flower are regarded as merely modified leaves. The sepals are generally green in color and the resemblance can easily be seen. The petals are also leaflike in their structure, but in the stamens and pistils a much closer examination will be required to establish the relationship. It can be shown that in many plants, as in the pea and bean, the pistils are identical in appearance with folded leaves, and in case of the stamens we know that they are transformed into petals, in the case of double flowers and then the resemblance to leaves is quite marked.

It has been noticed that in some species of plants, the length of the stamens and pistils is not constant in all flowers, as in one we may find long stamens with short pistils (Figs. V. VI), and in another plant of the same species there may be short stamens and long pistils.

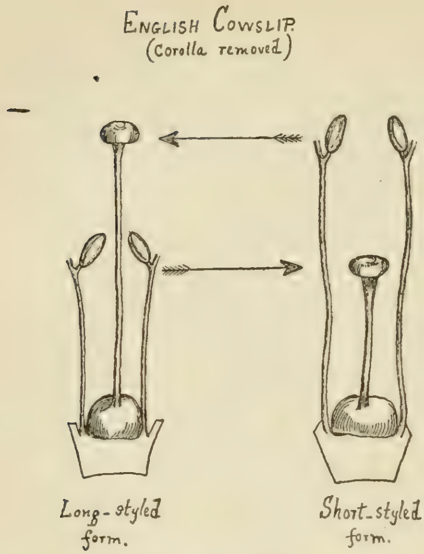


Charles Darwin spent months in studying this peculiarity, and has given the results to the public in his book, "Different Forms of Flowers in Plants of the Same Species." He found, as the almost invariable result of hundreds of experiments, that far better results were obtained when pollen from the long stamens was placed on long pistils, than when they were allowed to fertilize the short pistils. As the short pistils were in the same flowers with the long stamens, this was of course self-fertilization, and the results were identical with those also published by Darwin in "Cross and Self Fertilization in Plants," and he explains the diversity in the length of the essential organs as one of the means employed by nature to bring about cross-fertilization.

In the flowers where these differences were noted, the aid of insects in transferring the pollen is necessary, and the different lengths rendered it more likely that a cross would be secured. It was also found that, if pollen from the anthers of one plant was applied to the pistil of another, on the same plant, far better results were obtained than when it was applied to the pistil of the same flower; and if the pistil belonged to a flower of another plant, the results would be even more favorable, and a very marked increase in the amount of seed produced would be obtained.

In order to secure the benefits of cross-fertilization to plants, it is necessary to invite the presence of insect visitors. One of the means that nature has devised is the bright and showy colors of calyx and corolla. White

VI



seems to be the prevailing color, and it is the almost universal one that is found in flowers that are fertilized by insects that fly at night. A second means of attraction is found in the odors given off by many plants. As some of these are attractive to some insects and repulsive to others, it tends to induce the insects to only visit one species of flower, thus effecting a saving of pollen and increasing the chances of cross-fertilization.

A third means of attraction is afforded by the honey glands, or nectaries, that are possessed particularly by plants that need insect aid to transfer the pollen. As the bees flit from flower to flower, sipping the honey, they carry with them, on their legs or bodies, hundreds of pollen grains to be deposited on the stigmas of other flowers. In addition to the different forms of flowers, we often find special contrivances to prevent self-pollination and secure cross-fertilization. When the stigma is *under* the anthers, we sometimes find the latter so situated that the insects can enter the flower and pass by them, without receiving any pollen. They bring in pollen from other flowers and deposit it on the stigma; and on leaving, the position of the stamens is such that they are dusted with pollen which they carry to other flowers.

Where the wind is depended upon for transferring the pollen, an enormous quantity is necessary, in order to secure thorough fertilization; and even then it may not be thoroughly performed, as it may be washed away or carried off or consumed by insects. This often leads to partial failure of our fruit crops. As a partial remedy for this, some flowers will not open so long as the weather remains damp and cloudy.

When the gardener grows crops under glass, during the winter months, he often finds it necessary to artificially pollinate them.

In case of the cucumber, the anther can be broken off from its receptacle, and the pollen can easily be rubbed off on the stigma of the pistillate flower. In pollinating the strawberry, a small brush is generally used to transfer the pollen.

It is by means of crossing plants of one variety with those of another

variety, or species, that many of our new varieties of fruits, vegetables, and flowers are obtained, and artificial pollination is now commonly practiced for this purpose. It is only necessary to select varieties, or closely related species, that flower at the same time, and apply the pollen from the anther of one to the stigma of the other.

To secure a true cross, the unopened flower should be enclosed in a paper sack, after removing the stamens from perfect flowers, and this should be replaced after pollinating, and allowed to remain for several days. The ovules will be the joint product of the two plants, and their character will be determined by the comparative potency of the parents. The influence of the cross seldom if ever extends beyond the ovules, although there have been well authenticated cases where the entire ovary was affected. When the seeds are planted, however, the full effect of the cross will be seen.

I have never seen a case where squashes, melons, or cucumbers showed any effect of the cross the first season, although many persons hold the contrary opinion.

The production of pollen in such quantities must be very exhausting to the plants, and many persons claim that fruit production is greatly lessened thereby, quoting the results obtained with corn at the Cornell experiment station, where greatly increased results were obtained when the tassels on alternate rows were cut out. The fact that so large a proportion of our new and productive strawberries are pistillate, would also seem to substantiate it.

Aside from its use in producing new varieties, the farmer can in a practical manner avail himself of the advantages of cross-fertilization in increasing the productiveness of his crops. The corn crop in particular is an easy one to cross, from the fact that the stamens and pistils are in different parts of the plants. In case a new variety is not desired, two strains of the same sort, from different parts of the country, may be planted in alternate rows. If the tassels are cut out as soon as they appear, from the plants of one variety, the pistils will be fertilized by pollen from the other, and a cross will be secured. It may require one or two selections to obtain a variety true to type, but it can be easily done and the results will be more satisfactory than could be obtained were the same seed used continuously, or even if a change of seed were made.

The botanist regards as a fruit, a ripe ovary and its contents. In some cases the calyx tube becomes a part of the fruit, and as in the apple and pear, it may be thickened and make up by far the larger portion.

One of the simplest divisions of fruit is into (1) fleshy, (2) stone fruits, (3) dry fruits. In the first class, the walls of the ovary or calyx are soft and quite thick, as in gooseberries, apples, and oranges. The stone fruits differ in that the inner portion of the ovary wall has become hard and forms the shell around the seed, while the outer part remains soft and pulpy, as in cherries, plums, and peaches. Among the dry fruits are lettuce, peas, grains, acorns, and strawberries.

In each of these classes we find the seeds themselves more or less hard, and with special arrangements to secure dissemination.

In some cases the flesh is attractive to animals and they are often carried long distances. Most of them are lighter than water, and if they happen to fall into a stream they may be carried half around the world. In some cases the outer walls burst and the seeds may be thrown a number of feet. Many of the dry fruits, as the milkweed, thistle, and dandelion, have long

hairs that allow the air to buoy them up and scatter them for miles around. There is also a large number of plants known as "tumble weeds" in which the fruit stalk, or at least the fruiting portion of it, bearing hundreds of seeds, breaks off and rolls along over the ground, scattering its seeds as it goes. Other seeds stick to the feet of animals or have special organs by which they fasten themselves to the clothing of man and the fur of beasts.

It will thus be seen that the real function of our flowers is the production of seed to perpetuate the species, and in the arrangement of the different parts, everything "from blossom to fruit" is arranged for carrying out this object, and for the dissemination of the seed.

Another pleasing selection was rendered by the quartet, who upon retiring were, with Miss MILLER, for her recitations, given a vote of thanks.

Adjournment till nine o'clock a. m., was taken after President LYON had read the paper here appended upon

CO-OPERATION WITH THE DEPARTMENT OF AGRICULTURE.

Down to the period of Col. COLMAN'S incumbency of the commissionership of agriculture, the position had been generally occupied by persons slightly, if at all, in sympathy with pomology or even with horticulture in its more general sense. Upon his appointment, however, his well-known sympathy with horticulture (which, at the west means, in large measure, pomology), led to the prompt institution and organization of the present division of pomology, a division which, although sadly hampered by insufficient appropriations and inadequate space, has already developed many valuable results and has done and is doing very much to build up and systematize the pomological interests of our country, which, however, are so intimately blended with those of general horticulture that it proves true in practice that the general result of its legitimate work inures largely to the benefit of horticulture as a whole.

As a first and radically essential measure, the division needs to be brought into intimate relationship with the horticulturists, and especially with the pomologists of the country at large, to enable it to properly comprehend the needs of those interested in this specialty, and to become familiar with accomplished results, as guides in its efforts for further improvement. As a means to this end the following circular has been put forth and a special agent charged with the working out of the desired result:

U. S. DEPARTMENT OF AGRICULTURE, DIVISION OF POMOLOGY,
WASHINGTON, D. C., November 1, 1891.

To the Horticultural Societies of the United States:

As a means of securing concerted and mutually beneficial action between the department and persons interested in pomology and kindred subjects throughout the country, it is suggested:

First, That, through the State Horticultural society or similar organization, provision be made in each state and territory for supplying to the department, for the division of pomology, a complete and annually corrected list of officers and members of state and local organizations of fruitgrowers, with their postoffice addresses and the specialties in which they are interested.

Second, That the secretary of each state society send to the department, for the division, as soon as determined, the name of the place and the date of each meeting, and, as soon as issued, the programme for the meeting.

Third, That each society, state and local, supply the names and addresses of members of a standing committee, consisting of reliable and experienced fruitgrowers, to

respond to the circulars of inquiry which may from time to time be sent out for the division.

The department, as far as practicable—

Makes free distribution of bulletins and other publications of the division of pomology as well as those of other and kindred divisions, upon the basis of lists of members furnished;

Invites the sending of specimens of new varieties for estimates of probable value, of unrecognized varieties for identification, and of known varieties from localities in which they are specially successful, for examination and description. On application, mailing boxes and franks will be sent for such purposes;

Distributes, at certain times, a limited supply of seeds, scions, or plants of imported or little known fruits, and these are placed for testing in localities where they are likely to receive proper care and suitable conditions of climate and soil.

The proposed co-operation will be greatly aided if the regular meetings of the societies of adjacent states are so timed that they do not occur on the same dates. This will make possible in some cases the attendance of a representative of the department at a series of state meetings, and it is suggested that the executive boards of state societies consider this when arranging for the dates of their annual meetings.

Very respectfully,
EDWIN WILLITS, *Assistant Secretary.*

The propriety and even necessity of the first suggestion will appear from the fact that, if lists come from mere local organizations, there will be increased liability to duplication of names. to say nothing of increased liability by the many to neglect the timely making of needful reports; while a statement of individual specialties will enable the division to determine what class of matter will probably prove most desirable to each person. A prominent object of the division must naturally be to build up and strengthen the various organizations through which it shall operate. To this end, as will readily appear, a greatly increased inducement to a large and continuous membership will be afforded, since to be a member insures the appearance of the name, address, and specialty upon the lists of the division, with the consequent participation in the distribution of its bulletins, etc. The propriety of this suggestion will become still more obvious from the fact that horticulture has come to be practically so complicated or interwoven with botany, entomology, mycology, vegetable Pathology, and several other divisions of the already extensive and complex department of agriculture, that there is, as doubtless there should be, the fullest sympathy and coöperation between them, so that the bulletins and other publications of these divisions may be readily obtained and freely distributed through the division of pomology.

The reasonableness of the third suggestion only need be stated to be appreciated, since the abilities of individuals may be so much more readily and fully comprehended upon a personal acquaintance, than upon reports from a distance. The statements of the customary practice of the division, contained in the last four parapraphs of the circular, scarcely require explanation or amplification, though the propriety of the last one may be enforced by a partial statement of actual experience of last year. As agent of the division, I was directed to attend the annual meetings of as many of the adjacent states as possible; but inquiry developed the fact that the societies of Michigan, Indiana, Kentucky, Missouri, and Minnesota held their annual meetings during the same three days. Under these circumstances, the object was but imperfectly accomplished by passing from place to place on night trains and attending a single session of the Michigan, Indiana, and Kentucky societies each on one of the three days.

The importance of the invitation to forward specimens of fruit, etc.,

will be the more obvious by stating that not only has the division a corps of pomological experts, but that these experts are constantly receiving specimens from all parts of the country both under name and for indentification and estimation, thus keeping well up with results throughout the country; and that, as an additional aid in identification, a museum of wax specimens, modeled and colored from nature and including specimens and the same variety grown in various soils and climates, is being prepared, which will be shown at the coming Columbian Exposition, after which it is to be arranged in the rooms of the division, to be used for purposes of comparison and identification.

With this brief statement of the matter, I add the suggestion that the entire subject receive consideration, by reference to a committee or otherwise, with the purpose of considering what action is desirable, and, if the proposition shall seem desirable, to devise and report the proper action to be taken.

Wednesday Morning Session.

The Wednesday morning session was called to order by President LYON who introduced Mr. WM. A. TAYLOR, formerly of Douglas, Mich., but now Assistant Pomologist of the United States Department of Agriculture who read the following paper:

WHAT THE DEPARTMENT OF AGRICULTURE IS DOING FOR HORTICULTURE.

"It is very generally believed by the farming public that the Department of Agriculture is doing a good work in behalf of our agricultural interests.

The voice of the people as expressed through utterances of representative farmers and through the columns of the agricultural press, indicates a lively interest in its work and a general approval of methods employed and results accomplished.

The great livestock and grain-growing interests have special reason for satisfaction with what has in recent years been done for them by the eradication of dangerous diseases and the publication of reliable statistics and crop reports. Though often hampered by lack of sufficient appropriation and by frequent changes of policy, the history of governmental work in the interest of agriculture, since its beginning in 1840, shows almost constant progress and widening of field. During recent years, in consequence of more liberal appropriations and the more judicious application of effort, made possible by the rapid advances in agricultural science, the progress has been particularly gratifying.

Though the attention given to topics relating strictly to horticulture has beeen comparatively small, there has been much accomplished in the past, as will be found by reference to the reports issued in previous years. For a time, experimental work was carried on and lists of varieties of fruits and vegetables were made, and reports published, together with cultural directions and advice concerning special crops. This work has been mainly abandoned in consequence of a lack of proper facilities and the

assumption of that work to a great extent by the experiment stations of the different states. The distribution of seeds, though often the subject of merited criticism, has resulted in general good. The best results achieved in this line have been for the grain-grower rather than for the horticulturist, apparently because the subject of grains has been more carefully investigated and more systematically studied. With adequate appropriations and the application of scientific methods by trained workers now available, there seems to be no good reason why as much should not be accomplished in this line for the horticulturist as for the general farmer.

DIVISION OF THE WORK.

As now organized, most of the work that is of particular interest to gardeners and fruitgrowers is done by four of the sixteen divisions, which, with the bureaus of animal industry and the weather make up the working force of the department. These are the divisions of entomology, vegetable pathology, pomology, and gardens and grounds.

ENTOMOLOGY.

The scientific work of the division of pomology is devoted, first, to study and classification of insects, whether injurious or not. A change of habit often develops a dangerous insect pest from a species previously harmless. It is thus found necessary to study and record life histories of insects not now injurious, in order to be able to more quickly discover the weak point for attacking, should the species become troublesome. Foreign as well as native species are thus studied and particularly those already troublesome in other countries and likely to be imported unawares.

As an instance of the care exercised in this regard, there may be cited the case of an insect enemy of the peach now found in the Bermuda islands and thought to have been brought there from the Mediterranean, where it has long been known as an enemy to the orange and some other fruits. As it is figured and described in the department report for 1890, it can hardly reach the coast of Florida before being recognized and reported.

To provide for better facilities for this study of life histories, a building has just been erected where temperature and other conditions can be controlled and the work done more accurately.

Experimental work with insecticides and apparatus for applying them is carried on by special agents of the division in different parts of the country, and the search for parasitic foes of injurious insects is kept up both at home and abroad. The successful combatting of the cottony cushion scale, in the orange groves of California, by means of vedalia cardinalis, introduced from Australia, has stimulated effort in this direction, and several importations of parasitic insects have been made. One of special interest to horticulturists is a re-importation of a European parasite of the cabbage worm, which has been successfully placed at Ames, Iowa, and is reported to have become very abundant and to have greatly reduced the number of cabbage worms. An agent has also been sent to Australia to investigate and, if thought advisable, to import certain beneficial insects likely to be valuable in California.

VEGETABLE PATHOLOGY.

As is indicated by its name, the division of vegetable pathology devotes its attention to diseases affecting plants. This is comparatively a new line of scientific work, and in consequence much attention is necessarily paid to work of description and classification of fungi and bacteria affecting plants.

When reports of new plant diseases are received, specimens are secured and a miscroscopic study is made to determine the cause of the disease if possible. Usually this is done by growing the suspected germs in artificial culture media, such as sterilized gelatine or solutions selected for the purpose. Inoculations are made on healthy plants, with germs thus grown, and if the diseased condition results it is regarded as satisfactory proof that the germ sought has been isolated. The life history of the germ is then studied, to detect the period in its existence when it is most susceptible to attack, and various remedies are tested in a small way until some are found that are thought to be at the same time safe and efficient. These are then tested on a larger scale, under similar conditions, in regions where the disease is most disastrous, with a view to determining the most efficient of the remedies tested, their comparative cost, and the best and most economical means of applying. Results obtained are published from time to time with directions as to methods and means of application of the remedies. These published results are sent to all persons who apply for them, or who are known to be interested in the matter.

The methods of preventing and controlling black rot and mildew in the grape are now so well known that they need not be mentioned here. Experiments on that subject have been continued, however, during the present season, and it has been found that much less copperas is required than was formerly used in Bordeaux mixture, thereby reducing the cost of application from $14 per acre to $2 per acre. The experiments on control of twig blight in nursery stock, conducted at Geneva, New York, during the season just past, under direction of one of the assistants in this division, have been made on some three million trees of cherry, apple, quince, pear, and other fruits in nursery, and are regarded as very satisfactory. Work on pear blight, California vine disease, diseases of citrus fruits, rot of sweet potatoes, and a bacterial disease of oats, is in progress, as well as that on a number of diseases affecting greenhouse plants and some fungous diseases affecting insects.

The investigation of peach yellows has been actively continued, and as a result of three years' work with every fertilizer likely to have the desired effect, no instance has been found either of prevention or cure of yellows in the peach by fertilizers. This has been a disputed point among the investigators of the subject and its settlement narrows the field and indicates the line of research for future work. A more virulent disease than yellows has been discovered on the peach in Georgia, and the fact that it is readily communicable by bud inoculation has been established. A bulletin is now in press giving the results of these investigations.

GARDENS AND GROUNDS.

The division has charge of the grounds and greenhouses of the department. Formerly much experimenting was done, particularly with fruits,

but the gradual encroachment of buildings and permanent ornamental planting has so reduced the available ground that but little experimental work is attempted. The attention of the superintendent of gardens and grounds is now largely devoted to the propagation and distribution of plants and trees likely to be of economic importance. Over 100,000 specimens have thus been sent out during the past year to different parts of the country. Judgment is exercised as to the probable adaption of species and varieties to the region where they are sent and to the economic importance of the plants distributed.

The success of the Russian apples, the Japanese persimmon, the Washington Navel orange, and numerous other fruits introduced mainly or entirely through the efforts of the division, are indications of the good it has accomplished.

A catalogue of economic plants has recently been issued, and a bulletin on horticultural and kindred subjects, which has been very favorably received by the horticultural public. It contains a number of articles prepared by the superintendent of gardens and grounds and previously published in the annual reports, but now brought together in convenient form for reading and reference.

POMOLOGY.

The work of the division of pomology naturally divides itself into three lines:

First, the scientific: This includes such investigations in economic botany as seen necessary at times to establish a foundation for experimental work in the improvement of fruits. An instance of this is the work done by T. V. Munson of the division, on the wild grapes of North America. A preliminary bulletin has been published on this subject, giving a revised classification of the genus Vitis with suggestions to experimenters on the grape, based on cultural as well as botanical characteristics of species. Colored plates showing fruit, wood, and leaves of the more important species are in preparation and will be ready as soon as funds for publication of the complete monograph are available. A similar investigation of the genus Prunus, which contains our native plums and cherries, is badly needed and promises rich returns for the labor spent on it, but the fund now at the command of the division is not sufficient to justify the undertaking until other work already begun is nearer completion. The same cause prevents a thorough and systematic investigation of other wild fruits, as the working force of the division is kept fully occupied by office work and only a very limited sum is available for the work of field agents.

Second, the economic: Under this head come investigations of foreign fruits likely to succeed in this country and importations of promising varieties. This requires a careful comparative study of soils, climates, and markets and of labor conditions as well, for a fruit crop is not necessarily profitable because the yield and quality are satisfactory. Selling value and cost of production are important factors. It is in this line that the recent importations of date palms have been made and placed at different places in New Mexico, Arizona, and southern California, where the conditions indicate that the date of commerce can be profitably produced. Importations have also been made of choice varieties of the fig and of Persian grapes and of the market varieties of the citron of commerce, of

which thousands of dollars' worth are annually imported from Europe and Asia. Under this head comes the investigation of the subject of nut culture, now in progress. Systematic inquiry has been made in all parts of the country concerning the extent of which the growing of nuts for market has been carried on, and a number of important and interesting facts have been brought out. The report on this subject now awaiting the completion of the illustrations, will discuss varieties, improvements already made and likely to be made. methods of propagation and culture, adaptation of varieties to soil, and methods of marketing, etc. As a means of drawing attention to our leading market fruits and stimulating foreign interest in our orchard products, the division recently sent to the Scottish Horticultural association meeting a small exhibit of leading varieties of market apples from several states. These were collected and contributed by a few public-spirited growers, including your worthy president, and forwarded with the growers' names attached.

Third, the Advisory: The third general division of the division may be called advisory. It consists. first. in the publication of information to growers, concerning varieties. methods of culture, etc., of various fruits. There have been issued thus far in this line a report on tropical and semitropical fruit, in the United States, Russian and other fruits in the northwest, and one on the relative merit of various stocks for the orange. There are in course of preparation similar reports on small fruits, the apple and the peach. So far as adaptation of varieties to localities is concerned, these are based on reports of correspondents numbered by the thousand and living in every state and territory in the Union. The reports will be illustrated and will contain descriptions of recommended varieties and a carefully revised list of accepted names and synonyms. The second division of this line of advisory work brings the division into immediate contact with the fruitgrowers, and forms one of its most important duties. This consists of the examination of new, and identification of old, varieties of fruits and other matters requiring an immense amount of individual correspondence. As an illustration of what is done in this line, I have made the following analysis of work of this sort done in October 1891, as shown by the correspondence files and office records.

Letters written during October	584
Relating to identification of varieties	73
" " examination and opinion of value	69
" " nomenclature	20
" " choice of variety for particular localities, methods of culture and pruning etc.,	422
Samples consisting of fruit, from one to many specimens each, received for examination during the month	537

This may be taken as a fairly representative month, so far as the amount of office work of the division is concerned, though the nature of it changes with the subjects receiving the attention of fruitgrowers at different seasons of the year.

In closing this brief review of this part of the work of the department, it should be stated that any subject connected with agriculture is given careful attention, and if possible the information desired is furnished whether it comes within the field of any organized division or requires special investigation. The aim is to make the department a practical working aid to farmers, whatever their individual line of work may be, and as such it looks to them for their influence and support in its demands for

the appropriation of sufficient funds by congress, not only to meet its present needs but also to provide for other lines of work that are seen to be necessary.

RECENT INVESTIGATIONS CONCERNING PEACH YELLOWS—NOTES OF DR. SMITH'S WORK DURING 1891.

Since the publication of the first bulletin on yellows, in 1888, there has been a considerable increase in the infected area. The southern boundary of the region where the disease is prevalent, has moved south some twelve or fifteen miles, and during the three years. A large number of new cases have developed during the last season, in the mountain region of western Maryland, where peach-growing is a comparatively new industry, and in parts of New Jersey not previously infected, so that no portion of the latter state can be said to be free from the disease. It has also been frequently observed in Connecticut. West of the Mississippi it has appeared in northern Texas and in Arkansas, and is reported to have appeared near Davenport, Iowa, though its appearance there is not positively established. In Michigan it has been reported as on the increase about Fennville, and at least a portion of this increase seems to be due to laxity in the enforcement of the yellows law and prompt destruction of infected trees. Attempts have been made there by growers to prevent or cure the disease by the application of certain washes and mixtures, rather than to promptly destroy the infected trees, which is thus far the only preventive known.

Yellows has also appeared at Ann Arbor but has been promptly taken in hand by an active and efficient commissioner. Most of the cases reported from there are found in orchards planted with trees from New Jersey, and Dr. SMITH regards it as an unsafe practice to plant trees grown in that state or in infected localities anywhere.

In one orchard, composed partly of five-year-old trees, grown in a locality where orchards were badly diseased, and partly of six-year-old trees from a locality where the disease was known to exist, though not to so great an extent, the development of yellows in a single year numbered forty per cent. of the five-year-old trees and only twenty-five per cent. of the six-year-olds. He has found unmistakable cases of yellows in nurseries and has established the fact that in trees budded from the apparently healthy side of a tree partially diseased, the disease may remain dormant at least two years.

Three years of experiment, composed of 125 distinct tests of fertilizers in different combinations, and on an area of forty acres, with an equal area under like conditions but without the fertilizers, show no indications of the possibility of either the prevention or cure of yellows by the use of fertilizers. In some cases the treated trees show even a higher percentage of diseased trees than do the untreated ones.

In the course of the investigation of yellows, Dr. SMITH has discovered and investigated a new disease of the peach that has thus far confined its attacks to Georgia and Kansas. This is apparently distinct from yellows. It usually shows first in the earlier starting of the buds in spring, and a peculiar bunched appearance of the growth which gives it the name "rosette." Usually the whole tree is attacked at once, though sometimes only a portion of it. If it sets fruit the fruit drops before ripening; it never prematures its fruit as do trees affected by yellows. Commonly the

tree dies within a year after it shows its first symptoms, though in a few instances trees partly attacked in spring show leaves again next spring. Trees attacked during the summer and fall show the symptoms by the pushing of winter buds that should remain dormant. In an experiment with bud inoculation, out of 125 trees budded from a diseased tree, 121 showed rosette within a year; the buds inserted on the four remaining healthy did not "take." The native plums, Prunus Americana, Prunus Chicasa, and the introduced Japanese plums, such as Kelsey, show a very similar disease, and experiments are now in progress to determine positively whether the diseases are identical.

In some portions of Georgia the effects of the disease, as evidenced in the orchards, are as disastrous as the effects of yellows in Maryland and Delaware. So far as is now known, the disease first appeared some five or six years ago in Georgia and about three years ago in Kansas. It is a serious menace to the southern peach-growers, only less dangerous than yellows because of the fact that the fruit does not reach the market and so does not damage the sale of healthy fruit, as was the case this year in the markets of our eastern cities. The cause is not yet determined, but there is every reason to believe that the continued and well directed work of the division will eventually discover it and after that a remedy or preventive. Till then the axe and fire are the only safeguard."

CONCERNING YELLOWS.

Mr. TAYLOR was asked, Are the people in Delaware enforcing their yellows law? and replied: The Delaware legislature passed a local act, not covering the part of the state where yellows most prevails, and even in the section it covers it is only partly enforced. They are not as thorough in cutting the trees as they are in Michigan. Development of yellows was greater this year than usual in Delaware and Maryland, in some orchards affecting 60 per cent. of the trees. Its greatest development was in the young orchards in the mountain regions of western Maryland, where all conditions for growth of the peach are favorable.

Mr. ALEXANDER HAMILTON of Ganges: There is a difference of opinion and practice in my vicinity as to the cutting of peach trees diseased with yellows. Some contend that they should be cut, uprooted, and burned at once, utterly destroyed; while others believe that it is sufficient to cut and leave the tree, afterward either drawing it out or burning where it stood. The Ganges commissioners permit the latter, while Mr. WILEY of Saugatuck township requires immediate destruction. Mr. SMITH should be accepted as authority upon the matter.

Mr. J. N. STEARNS of Kalamazoo: If no growth ensues from the old stump, there is no danger from leaving the cut tree in the orchard till some convenient time for removal.

Mr. R. MORRILL of Benton Harbor: There should be no dallying with yellows. Rather than carry out the diseased trees at any time, I would burn them at once upon cutting.

Mr. N. Atwell of Lawton: I have seen a pathway of yellows where a diseased tree had been drawn out through an orchard.

Mr. Stearns: I have drawn out dry trees with no bad results.

Mr. Morrill: Has Mr. Smith determined the time of contagion, the time when the principle of contagion is active?

Mr. W. A. Taylor: I can not answer fully as to that; but buds set at or near the close of the season of growth, have caused yellows in the stock below, even when the bud itself did not grow. There is possibility of the disease remaining dormant two years and then developing.

Mr. Morrill: Then it is never safe to prune a suspected tree and go to others without disinfecting the knife.

Mr. Taylor: I do not think Mr. Smith has case's of communication by saw and knife, but it is quite possible for the disease to be spread by that means; and it is easy to disinfect tools with carbolic acid. The Californians are fearful of receiving yellows through eastern trees, and are guarding against it; but, though many carloads of such trees have been received and planted there, no case of yellows has yet developed.

Mr. J. F. Taylor of Douglas: In view of the experience of those who have done most cutting, it is evident that yellows may be so checked as to be kept back beyond the line of serious danger. After the notable epidemic of the disease in 1879, cutting of trees was very general and there has not been much of the disease since. I do not want in my orchard a tree with disease of any kind. Peach trees are the cheapest of all nursery stock and so there is no incentive to keep unhealthy ones about. Root them out and plant anew. If one cuts promptly all suspected trees he will have little trouble from yellows. In my vicinity there is no fear of it.

Mr. W. A. Taylor, in reply to a question: Mr. Smith's experiments have been conducted in Michigan, Maryland, Delaware, and Georgia.

Mr. J. F. Taylor: It would be well to try experiments of inoculation of yellows in regions where the disease does not exist.

Mr. W. A. Taylor: There is no yellows about Hubbardston, where some of Mr. Smith's experiments are conducted upon his father's farm.

Mr. Morrill: In Mr. Smith's report, in this society's Report for 1888. there is an illustration of a disease he found in Georgia, which he presumed to be different from yellows. Was it in fact the disease called "rosette" by Mr Taylor in the paper just read?

Mr. W. A. Taylor: It is.

Mr. Morrill: I saw something at Judsonia, Arkansas. four or five years ago, of which that illustration reminded me.

Mr. C. A. Hawley of Shelby, to Mr. Morrill: Are you now growing peach trees where yellows had destroyed those previously planted?

Mr. MORRILL: Yes; and it has been fully demonstrated at South Haven that it may be safely done.

Mr. A. G. GULLEY of Agricultural College: I have a six-year-old orchard at South Haven standing where trees diseased with yellows were pulled out two years before this orchard was set. But in that vicinity there are plenty of healthy trees growing where diseased trees were pulled out only the season before replanting.

OUR BARREN APPLE ORCHARDS.

The secretary read a paper by Mr. A. C. GLIDDEN of Paw Paw on the above topic:

"Barrenness in fruit trees may come from various causes. Some of these causes are well understood, while others are set down as dispensations too mysterious for successful inquiry. There is a good deal of stress usually laid upon "bearing years" and some go so far as to say that years with even numbers are the bearing years, and the odd numbers the barren ones. Acceptance of all such frivolous conclusions is a disclosure of a state of mental laziness, not conducive to the highest success in fruit-growing. There are always good and sufficient reasons for events in nature, as well as in human affairs. There is no capriciousness in the goddess who governs the bloom and the maturity of fruit, and no perverseness toward those who make a business of their production.

The limit of my theme will not allow me to go over the causes of barrenness in fruit in general, and I shall not allude to them except to illustrate my subject. Barrenness in apple trees comes largely through natural tendency in usual seasons. The tendency of varieties to set to fruit, as it is termed, or not to do so, is generally understood. The Baldwin is an illustration of the former and the Northern Spy, while the trees are young, and several other varieties not so well known, because of this tendency, of the latter.

Propitious seasons stimulate unproductive trees into fruitage in occasional years, and they then again lapse into unfruitfulness for a longer or shorter period as the seasons may determine. But when what we term fruitful varieties fail for a season, and especially when two successive seasons of failure follow, it is well to inquire into the causes that have produced such an unwonted occurence. How much tendency, or a habit introduced by force of circumstances, has to do with bearing years, it is hard to determine; but bearing to excess in one year is reason enough why an apple tree should fail to bear the next. The peach-grower who properly thins his crop, sees no "tendency" toward alternate bearing; if the season is favorable, he expects a crop as certainly as the season's return. But when the trees are allowed to strain themselves toward perfecting the entire setting, a barren year will surely follow.

The effort of nature is not to perfect the pulp which we utilize. It is only anxious for a large amount of seed to insure the perpetuation of the species. In this effort, if allowed to indulge its own sweet will, it puts forth all its powers for that purpose, and has no reserve force left to go toward the production of buds for next season's fruitage; so we have a year of

rest and fruit bud maturity, and a year of fruitage, when every other effort is subordinated to this end. A climatic disturbance which destroys the promise of fruit in "the bearing year" may yet allow the trees to provide buds for next year's crop and reverse the heretofore recurring fruitful season; so that no unfailing dependence can be placed upon bearing years to alternate regularly for all time.

I now come to the causes which have made the last two seasons conspicuous failures over a larger area of apple-producing country than has been known in many years. This area lies between the fortieth and forty-fifth parallel, being central nearly where we stand, and running east and west from New York to eastern Iowa. There has been a great deal of speculation regarding the true cause of this unwonted failure. Our scientific investigators, when pressed for an answer, have bent their energies toward the discovery of some lurking disease the diagnosis of which none but themselves could understand, and so escape the imputation of ignorance through a dust cloud of terms.

Early in June last year we all discovered that something was the matter with our orchards; the leaves lost their luster, dried up, and fell off. The effort at producing new foliage was weak and ineffective. In describing the condition of the apple trees, in a letter to the Country Gentleman at that time, I inclosed samples of the leaves, which that paper forwarded to Prof. LITNER at Albany. In answering some of my queries in the reply, which was published as an addenda to my letter, the professor attributed the whole difficulty to apple scab fungus. Prof. L. H. BAILEY, in a paper read before the cider and vinegar makers' convention at Rochester, last year, gave this truthful appearance of the orchards in the fruit counties of New York: "The failure of the apple crop in New York was never so complete as in 1890. The trees blossomed very full, but the fruits failed to set. The spring was exceedingly wet and mostly cool. Shortly afterward, the blossoms withered and fell, and the leaves of apples, pears, and quinces began to blight. The rains were succeded by drouth, which, in some sections, became very severe. During the early part of the season the blight of the foliage increased, until in July, when I inspected the orchards in Niagara, Orleans, Monroe, Ontario, and Cayuga counties, there were thousands of acres of apple orchards which appeared to be dying. In many places the quince orchards appeared to be scorched, and the foliage of the pears was speckled; peaches dropped their leaves and fruits early in the season. The blackberries, and later raspberries, in some sections, dried up, and the bushes looked unhealthy. It is probable that similiar injuries extend, in a greater or less degree, to all parts of the state."

He also pronounced the disease a fungus difficulty, and gave a formula for a solution with which to spray the trees to prevent a recurrence of the trouble. It was evident to me that the trees were suffering from something more radical than fungus, for a tree, with undisturbed functions, rallies at once from such trivial attacks. Professor BAILEY indeed disproves his theory when he reports all trees and shrubs alike suffering with the same disease. I expressed my opinion in a letter to the above mentioned journal, in August of last year, that the cause of the wide extended failure of apples was due entirely to the climatic extremes during the winter previous.

I have no doubt many of you remember the many warm days in January of 1890—that we revelled in a tropical climate and congratulated ourselves that we were not induced to go to Florida or to southern California to spend the winter. Fortunately we are not left to our memories to prove this

abnormal climatic condition. The record of the weather bureau at Lansing, for that month tells the whole story. It shows that on the 11th the temperature rose to 63 at Williamston near that city; that the mean daily temperature was above the normal for 26 days in the month; that the ground had not been frozen solid, and that plowing was in progress in Wayne county at the close of the month. A fruitgrower near Paw Paw, one of our close observers, fearing the effect of of this high temperature upon his peach crop, broke off a small branch and placed it in tepid water in his room. It there burst into bloom in a few days, showing that the sap had begun the process of transformation and that considerable progress had been made toward developing the bloom. Had this kind of weather occurred in April instead of January, that fatal fungoid epidemic which scientific investigators found so widespread in the summer following, would never have appeared; but another extreme followed early in March. The record kept by A. H. SMITH of Paw Paw, shows the following range of a self-registering thermometer: March 2, two degrees; 4, four degrees; 5, five degrees below; 6, eleven degrees below; 7, two below; 8, two degrees; April 8, 72 degrees; 9, 25 degrees. Remember, now, that the cell work of starch and gums and other essential pabulum laid up in the wood structure for the development of the next season's leafage and fruit, had been broken down by the untimely heat, was dissolved by the ascending sap and set flowing into the circulation of all plants alike. Is it at all strange that just such an effect was produced as Professor BAILEY describes, and as you all remember to have seen? Had the buds remained in their normal dormant state, the eleven degrees below zero would not have been extreme enough to have killed even the peaches, but here was an unusual condition: sap in flow and growth begun when suddenly arrested by zero weather for six days. It is almost a wonder that the trees themselves did not die. Indeed, so nearly dead were they last season that no adequate provision could be made for the crop which many thought would certainly come this year because of the failure last. In the state crop report for May last, the correspondents were asked regarding the prospects for fruit. I then stated my belief that apples would again prove a failure, giving substantially the same reasons as here expressed for my opinion.

There is one other cause of barrenness in apple trees which I shall not take time to discuss. I allude to the lack of nutrition in the soil. Orchards are quite frequently cropped as long as anything will grow around the trees, and then cursed for their inability to respond in abundant yields of fruit. A tree under such circumstances is a stubborn thing. When it strikes this barren attitude it will remain in that surly mood until the conditions change, or the owner sells or is sold out. Then it may smile again in plenteous bounty after its wants are met, and be a generous aid to increase the income of the new owner.

A STUBBORN NEW YORK ORCHARD.

Mr. L. B. RICE of Port Huron: I have in Wayne county, New York, an orchard of 225 trees set on the south slope of a hill; most are Baldwins but some are Greenings, but in 24 years I have not gathered 24 cents' worth of fruit per tree from it, save one year when I got a fair crop of Greenings. I have cultivated it and let it alone; seeded it and plowed it up; cut the grass and let it grow. The orchard is on good soil · the same

soil on the north slope of the hill produces abundantly, and across the fence on the same slope it is productive. The trees are large and thrifty. Now I would like to know what to do with that orchard.

Mr. MORRILL: Mr. WINANS of Benton Harbor had such an experience, and brought about continued fruitfulness by "ringing" (girdling) the trees. The main limbs were the part girdled. The work was done in June and cutting was made down to the cambium layer.

Mr. SAMUELS: Cut down the orchard and devote the ground to potatoes.

Mr. RICE: I had supposed the Baldwins to be top-grafts upon Colvert; but since reading Mr. BEECHER'S paper at our last annual meeting, stating the quality of the Colvert as a stock, I have concluded the trouble was there; I have reason to suspect the stocks were Spy.

Mr. ALEX. HAMILTON of Ganges: I do not believe the root [stock] makes any difference as to fruitfulness.

Mr. SAMUELS: Have you had the soil analyzed?

Mr. RICE: No; but good apples grew there when I was a boy.

Mr. HAMILTON: I think the trees are not old enough, that they will yet bear well. The orchards of Mr. SPENCER and Mr. BARAGAR, in my vicinity, and one of my own, mostly of Baldwins, bore nothing for twenty years or more.

Mr. A. G. GULLEY of Agricultural College: If Mr. RICE'S stocks were Spy, their influence may still be felt.

Mr. J. F. TAYLOR: Underdrainage is a thing to look into. The soil may be made dry enough to check growth and so cause formation of fruit buds and continuous bearing.

Prof. L. R. TAFT: Underdrainage was effective with the old apple orchard at the Agricultural College. From my own experience I agree with Mr. GLIDDEN as to injury to foliage of fruit trees by some widely extended climatic disturbance; but there were great growths of fungi, induced, very probably, by those untoward conditions. There was the apple-scab fungus, and another which caused the leaves to turn yellow. and which at the college was not affected by spraying; the latter was not so prevalent upon cultivated trees as upon those uncultivated.

Mr. RICE: There is a twenty-foot well in one corner of that orchard. It is usually dry, but the water never comes nearer the surface than twelve feet. But the trees do no better nearer the well, so the trouble can not be lack of drainage. The subsoil is hardpan and the soil several feet deep though varying.

WM. P. GREEN of Eaton Rapids spoke against the use of water-sprouts for grafts. They grow rapidly but are slow of fruitage.

Mr. RICE: The grafts for those trees were cut from old bearing branches—I was bound to have it all right.

Mr. D. G. EDMISTON of Adrian advised pruning; he had known an orchard to become fruitful from being cut over for scions.

Mr. RICE: The orchard has been thoroughly pruned.

Mr. MORRILL: I will wager a fat sheep I can suggest something Mr. RICE has never done for that orchard. Have you ever tried sub-irrigation?

Mr. RICE: No.

With laughter the meeting abandonded Mr. RICE'S phenomenal apple orchard as something quite beyond their remedial knowledge.

PEARS AND THEIR CULTIVATION.

Mr. J. N. STEARNS of Kalamazoo followed with the subjoined paper upon "My Experience in Growing Pears:"

I have promised our secretary to give some of my experience in growing pears. In the first place, I will enumerate some of the mistakes I have made.

The first, in planting some varieties in which there is no profit to me. Next, in not planting dwarfs deep enough and in not keeping them headed back sufficiently; and in earlier years in not being prompt in cutting out blight, and in planting profitable varieties on soil not adapted to them.

THE PEAR IS PROFITABLE.

I have faith in the pear as being the most remunerative of any of our large fruits, not excepting the peach in its most favored locality. My experience and observation is we have a few varieties that, if planted on soil adapted to them, we may grow successfully in any part of this state. It is generally understood that a strong, clayey soil is best for pears, but we have a few good varieties that do well on the lighter soils, if kept well fed and cultivated, such as Bartlett, Howell, and Louise Bonne. It will not pay to plant the Angouleme, Anjou, or Sheldon on any but strong, fairly heavy soil.

PREPARATION OF THE GROUND AND CULTURE.

The ground should be well fitted before planting, by being worked very deep by using a subsoil plow, and made rich with fertilizers (if not so naturally), and should be so worked or underdrained that no water will stand long on the surface after heavy rains. While I am speaking of working the soil I will say I am one of the few that believe in cultivating the pear orchard just as thoroughly as the peach orchard. I know it is advocated in the papers, and at horticultural meetings, to cultivate only for the first three or four years, then seed down, to prevent blight. But I have an orchard of one thousand trees, of which most are twelve years old, and it has been thoroughly worked every year during that time, except that a portion of it was left in grass for two years, as an experiment—

which proved very unsatisfactory; and I had but one tree show signs of blight this season, while pears within three miles of my place, standing in sod for years, were nearly ruined by blight the past two years. But I should mention that blight was unusually bad all through our part of the state, one year ago, and at that time we had quite numerous attacks of it; but we made a regular business, one day in every week, to go over the whole orchard, cutting out every vestige of blight, and being sure to get below the affected part. These branches were promptly carried out of the orchard and burned. To this vigilance I attribute our almost entire freedom from the disease the past season.

The standard pear needs but little pruning, but I would recommend the cutting back of nearly two thirds the young growth of dwarf pears. If this is not done, and they are not planted deep enough to become in soil half-standard, they will become top heavy and tip over.

COMBATING INSECTS AND DISEASE.

The time has come when, if we wish nice fruit, we must be vigilant in fighting the various injurious insects. I have been much troubled with the dropping of the leaf on my plums and some varieties of pears, thereby preventing the fruit from properly maturing. The past season I sprayed my pears and plums, with the Bordeaux mixture, hoping to head off this difficulty, spraying the first time before the trees blossomed or leaved out, giving them a thorough coating so the limbs and bodies looked blue when they became dry. After the fruit set I sprayed three and four times more at intervals of a week or two according to the weather. In these later sprayings I put into the mixture Paris green at the rate of one pound to two to three hundred gallons of water to destroy the codlin moth and the curculio. If it was through this treatment that the trees held their leaves so perfectly, notwithstanding the extreme dry season, this one thing, as advocated by our experiment stations, is worth more to the country than they have all cost.

MATURITY AND MARKETING.

When the pears are about one fourth grown, I go over the orchard and thin them. Instead of thinning as we do the peaches, to four to six inches apart, we pick off every pear imperfect from any cause, if it takes off all for two feet and then leaves four in a bunch. Experience has taught us that the pear will develop all right in this way if on the whole the tree is not overloaded.

The pear, differing from other fruits, should never be allowed to ripen on the tree. The quality is much better if, when fully matured, they are picked and allowed to color and ripen in the keg or barrel. One season I had thirty bushels of Bartletts blow off when not much more than half grown. I thought them worthless, but after they had lain there a few days I was induced by a solicitor to pick them up for shipment; and they brought me as good a price as any shipped that season. Some of them remained in the packing room until they ripened, and I was greatly surprised, as the quality was equal to that of any of the fully matured fruit. Not all varieties will do this, but the Bartletts may be picked when apparently very green and yet mature in fine shape.

My practice is to make two grades of my pears, putting the select, per-

fect, even-size fruit in kegs holding one bushel. with my brand on and card inside: and the imperfect, smaller-size in bushel baskets. In this way I have been able to get fancy prices for the select, getting calls for them from all over the west and south. But a few weeks since, I received a letter from a man in Georgia saying he had had several kegs of my pears, and inquiring if I could not ship direct to him.

I mention this as an illustration of a very important point in the profitable growing of pears for market, and it is equally applicable to all fruits.

We should so grade and put up our best fruits that they will sell themselves. If we would do this we would not hear the question so often asked, where do you find a market for so much fruit?

In conclusion I will say, I have never had enough of this class of fruit to fill all orders.

EXPERIENCE OF OTHERS.

Replying to a question, Mr. Stearns said he would add the Clapp as a pear succeeding fairly on the lighter soils. but would not plant many of them. He finds no profit in Kieffer—can not sell it.

Mr. Evart H. Scott of Ann Arbor: I had fifty-nine barrels of Kieffer from 100 six-year-old trees and they brought $3 per barrel. I have some still in my cellar and find them better in quality than I supposed they would be. considering what the pear is at the south. What I have seen from there were worthless. I have ripened the Kieffer the last three years on clay; I think it better when the fruit is small. But I do not consider it good nor think it will ripen each year in Michigan.

Mr. Rice: It has done first-rate at Port Huron in sandy soil.

Mr. Stearns: It is excellent for canning or pickling.

Mr. Gulley: It is worthless at the Agricultural college.

Mr. L. W. Wilton: What fertilizers are best for pears?

Mr. Stearns: Mainly ashes, but some barnyard manure for the dwarfs. Use of salt helps to retain moisture in the soil. Coal ashes are of no use. I would advise the forming of low heads for standard pears. The first I set, 800, were headed high and now can not be lowered. The low heads are more convenient in spraying and in harvesting and they sustain less injury from winds and sun. I would head standards at three feet and dwarfs at one. There is no known cure for blight. Eradication is the only effectual way of dealing with it. Cut one foot below the lowest appearance of blight.

Mr. Scott thought coal ashes useful on heavy soil, keeping it porous and therefore cool.

Mr. W. F. Bird of Ann Arbor: How do you manage broken limbs?

Mr. Stearns: Start a new bud and head in on the opposite side, to keep the tree symmetrical.

Mr. W. A. TAYLOR: There was a very large crop of Bartlett pears in the east this year, and there was no money in it; but neither was there any in the peach crop.

Mr. W. W. TRACY of Detroit: I know of old pear orchards in Pennsylvania in which the soil is very liberally manured and the trees cultivated, yet they are comparatively free from blight. I see pear orchards in New York, that have been in grass for years, yet they also are nearly free from blight. Disaster comes from change of treatment. Keep it uniform. Cut out the blighted limbs each week, or oftener if they appear. I used to carry a bottle of crude carbolic acid into which I dipped my knife-blade after each cutting.

Mr. A. A. CROZIER said he used to believe the only place for a pear orchard was sod, but now believes in cultivation, and otherwise in the views expressed by Mr. TRACY.

ANNUAL ELECTION.

To conduct the annual election, Messrs. STEARNS and GULLEY were appointed tellers and officers chosen as follows, a re-election in each case:

President—T. T. LYON.

Secretary—EDWY C. REID.

Treasurer—S. M. PEARSALL.

Members of Executive Board—C. A. SESSIONS, C. W. GARFIELD.

Wednesday Afternoon Session.

At the opening of the session a letter was read from the publishers of the Farmers' Review, Chicago, suggesting that an understanding be established between the several state horticultural societies, by which their annual meetings shall be held on successive dates. Under the present conditions, several of them meet at the same time. The societies of Kentucky, Missouri, Indiana, and northern Illinois, besides Michigan, are in annual session this week. This makes it impossible for papers like the Review to make reports of them all, as they would like to do, without incurring too great expense.

Mr. W. A. TAYLOR said that the agricultural department finds difficulties of the same kind. The department would like to send a representative to each of such meetings, but the simultaneous occurrence of so many of them prevents this, both because there are not enough suitable men in

the department to furnish one to each meeting, and that the expense of a separate journey to each could not be afforded.

Mr. Monroe moved, and it was carried, to instruct the executive committee to secure harmony in this respect with the societies of adjacent states.

A question was asked by Mr. H. O. Kelly of St. Louis, Gratiot county: Do our mild winters have a tendency to deteriorate the quality of Michigan apples?

Mr. Lyon: Not as a rule; but such would be the tendency of such a winter as that of two years ago; any season which promoted unnatural growth would do much harm.

To this Prof. Taft agreed, adding that the weakness of trees resulting from such unnatural seasons induces an increase of disease.

THE FRENCH DAMSON PLUM.

A letter was read from Mr. F. J. Russell of Hart, asking about the French Damson plum – when it ripens, compared with Shropshire Damson, what is its size, shape, habit of growth, degree of prolificacy, and comparative quality of fruit.

Mr. Nelson Bouge of Batavia, N. Y.: The tree is a fair grower, better than Shropshire Damson or the average plum; the fruit ripens sooner, is larger, and is more desirable to grow.

Mr. J. N. Stearns: This plum was recommended to me by Mr. S. D. Willard of Geneva, N. Y., and I have planted but not yet fruited it. Mr. Willard placed it above Shropshire Damson in all respects.

Mr. Bouge: The French Damson has no synonym; the stock now on sale in this country is from originally imported trees; the fruit is dark blue, high in color, with considerable bloom, and in size between Shipper's Pride and Shropshire Damson.

The following paper was read by Mr. Jas. F. Taylor of Douglas, upon

COMMERCIAL PEACH-GROWING.

Commercial life is a kind of occupation in buying and selling, or in producing and selling, that will give a man employment all the year and every year.

But there are off years in every worldly work. Not all are alike prosperous. Not all are alike remunerative. Times do come when the work is heavy and the income light. So, in commercial peach-growing, it is well to bear in mind that there are contingencies to be encountered at every step in the work and at every turn in the rolling year.

While the peach tree will grow in various localities over a wide range of territory and produce fruit occasionally, its adaptation to fruitfulness, from a commercial standpoint, has many limitations and conditions. These

limitations and conditions are all to be taken into the account in an enterprise that involves both capital and labor.

Soil, climate, location, access to market, facilities for shipping the fruit, varieties to be planted, the diseases of the tree, and the depredations of insect enemies are in the catalogue of queries to be considered in their bearing upon the success of an enterprise of this kind. These lie at the very foundation of prosperity. A mistake in regard to any one of them may destroy our highest anticipations.

LOCATION.

When commercial peach-growing is to be made a specialty, the selection of a suitable location is of the highest importance. If the work is combined with the growing of other fruits, a few acres may be found in different parts of our domain that will be productive a part of the time, and when productive may be exceedingly remunerative. But if a man turns his time, strength, and capital into one channel, he can not afford to work at random. He must have a location that will be highly favorable to the production of fruit. Comparatively small areas or tracts of country have a special advantage in this direction which makes them of superior value.

Location in this regard includes climate. Extremes of heat and cold during the winter months are often the cause of failure. A temperature low enough to prevent a large development of fruit buds until after the danger of spring frosts is over, is of great advantage. These frosts are the cause of failure in many places otherwise as favorable as could well be desired; and were it not for these untimely frosts, peaches would abound in nearly all latitudes south of the great lakes.

There are occasional failures in nearly all the so-called peach-belts of our country, and there are choice hill-tops and high lands which produce fruit with sufficient regularity to make the business remunerative. A knowledge of these things is quite essential to an intelligent choice of a desirable location.

PREPARATION OF THE GROUND.

A thorough preparation of the ground in advance of planting is very desirable. In many respects a sod turned under late in autumn or in early spring is decidedly preferable. The advantage gained in this way is probably more marked on light soils than on those of a more compact character. The first year in the orchard is always an important one in tree life. A vigorous growth after the roots have been cut and pruned goes far toward overcoming the shock of transplanting. If this beginning of the work is well and properly done, very much is gained in uniformity of growth and productiveness of trees.

VARIETIES TO BE PLANTED.

Not all are desirable. Some are worthless, others are not adapted to the soil or the market. We might assume that a fruit, being a peach, is worthy of cultivation, and plant everything grown under this name by nurserymen. This has been so, to the great disadvantage of many growers. But it is the commercial value of the peach that is now under consideration and

this value is due to the productiveness of the tree, the quality of the fruit, and its adaptation to transportation.

A desirable fruit from an unproductive tree is of little account, and yet there are many thousands of such trees growing in our best peach lands. Some valuable varieties may produce well in one locality and not in another. Slight changes in the surroundings of a peach grove may have marked results for or against profit. Only a few varieties have stood the test of all localities, in all respects. Those most highly prized for size, color, and quality are often most undesirable for producing fruit. Many a peach-grower has waited long and is waiting still for fruit from the trees he purchased at fancy prices by looking at highly colored pictures that appealed to his eye with their beauty.

For commercial purposes, a continual ripening of fruit, from the earliest to the latest, is not to be ignored. The advantage of this process is not only in a long season for sales but also on account of the climatic changes which so often have a deleterious effect on perishable fruits. If the early fruit is injured by too much wet or dry weather, the later may be greatly benefited; or the conditions may be reversed, so that what is injurious to one may add beauty and value to the other.

PLANTING.

The arrangement of plats and distance between trees is of some practical importance in facilitating orchard work. Sixteen, eighteen, and twenty feet are the spaces commonly allowed for cultivation. Good results may be secured from either distance; but the wider, or at least sixteen by twenty feet, on a fertile soil, furnishes better colored fruit and greater facility in all orchard work.

Trimming the tree to a whip, at planting, and cutting back the yearly growth in springtime, until the top is well formed, should by no means be neglected.

CULTIVATION.

This implies a yearly preparation of the soil for yearly growth of tree. It should begin in springtime when the grower wishes to aid nature in putting forth foliage and fruit buds, not too early, lest an untimely frost blast the grower's brightest hopes. It should be continued during the growing season; in times of drouth as late as September, at other times August first will be sufficient. If peach trees are allowed to ripen their wood before September, in the latitude of Michigan, the fruit buds are often developed by the warm days of autumn and become more susceptible to injury by the cold of winter.

In the Michigan peach-belt, corn may be grown among the newly planted trees during the first and second summers. The shading of the ground in this way is highly beneficial.

FERTILIZING THE SOIL.

Nature does not recuperate her exhausted powers rapidly. Human agency must come in to help make up the deficiency. In some peach-belts this is no easy task. Commercial fertilizers are always accessible at at some price, but how well they will produce the desired result may still

be a question. Yard manure has its uses, and in some soils is very desirable, even in a peach grove. A faithful stirring of the soil is commonly a sufficient fertilizer until the trees come into bearing. After that, something more is needed to maintain a vigorous growth.

Some growers, in their haste to get large returns, have killed their trees by forcing them too rapidly. A moderate growth of peach wood is productive of the best results. It will endure more cold in winter and more drouth in summer than if hurried into a rapid development. But impoverished trees will not bring desirable returns. A judicious use of fertilizers is among the essentials of this business.

INSECT ENEMIES.

These claim the growers' attention. The tree must be protected or saved from their ravages by continued vigilance. The peach-borer is an insidious enemy, but the work of counteracting its ravages is not difficult.

DISEASES OF THE TREE.

These are the greatest source of discouragement to peach-growing at the present time. Yellows, as the disease is called, threatens the destruction of commercial peach-growing in the most noted belts in our country. It is doing a deadly work. Where can a remedy be found? Who can step in and say it shall go no further? The man that can do this by any practicable means will be a great benefactor.

Where the disease does not prevail and where it is restrained by the use of the axe and cremation, the peach grove is undoubtedly remunerative; but unless its ravages are stayed by the potent hand of public sentiment and law, it may steal into every nook and corner of the land. It is already national in extent and will require a corresponding effort to eradicate it. Let every lover of the peach work for this end. Other diseases are less damaging to the interest involved and need not be dwelt upon here.

MARKETS.

When this fruit is in small supply, markets are open everywhere to receive and handle the inviting Crawfords and Red Cheeks; but when there is an abundance, every village and hamlet is supplied from its own surroundings and the fruit of large groves must seek a distant distribution. The larger peach-belts always require a distant market. The handling of such perishable fruit to the best advantage is still after years of experience a question of importance; and the grower is often at his wits' end to know how to carry on this part of his work successfully.

Facilities for transportation are as essential as the fruit itself. The evaporator and canner come in for all that can be used or preserved by such means; but the fresh fruit, well ripened on the tree, is palatable to so large a part of the human race that the demand for it is only limited by a lack of facilities for securing it. Let these be more extended and peach groves will soon be more abundant and more remunerative. Such perishable fruit must be put into the hands of the consumer without any delay. This fact always creates an emergency, and an emergency makes the carrying trade expensive to the producer. The demand for this fruit will

always be great, and the field for commercial peach-growing has only those limitations which come from nature and its own environments.

Ensuing upon this paper was a long discussion, occasioned by a desire of the Eaton Rapids people to learn what, for their vicinity, would be

DESIRABLE VARIETIES OF PEACH.

Mr. HAMILTON: It was inferred from Mr. CRAWFORD'S paper that peaches are not and can not be grown in the vicinity of Eaton Rapids; but I have seen high lands about the place where, were they mine, I would not hesitate to try peaches. I wish Mr. Taylor had named some of the hardier sorts that may be obtained from nearly any nurseryman in Michigan.

Mr. TAYLOR: To make a complete presentation of the subject of peach-growing, there should be a paper on varieties as well as upon each of several other points; but as to hardy varieties, I will mention some, in the order of ripening. There are many varieties that are equal to or better than the Crawfords; but some of these are not hardy, and the best varieties can not be carried far and retain their flavor. Hill's Chili is one of the hardiest but needs moisture and much sunshine for its proper ripening. It carries well, cans well, and but few know the difference between it and Crawford. The Lewis, Golden Drop, Barnard, Snow's Orange, and Jacques in many points can hardly be excelled. All these would be likely to do well, in most seasons, in Eaton county and other interior points of the state. Under normal conditions these will withstand—well, I have known them to endure sixteen degrees below zero and yield a full crop. But there are contingencies, as a warm autumn or winter, which develop the blossom buds though not the leaf buds. Under such conditions I would fear ten degrees below zero. Spring frosts are another source of injury, and in some localities the greatest of all.

Mr. SAMUELS: Has Mr. Taylor tested the St. John and Elberta?

Mr. TAYLOR: Indications are that St. John will be one of our best peaches, though it is as yet not much grown—not enough to fully test it as to hardiness. Elberta has not yet been fruited in my vicinity. I have tried to get Reeves' Favorite but failed—got something else that was worthless. The St. John was called Crane's Yellow, in our vicinity, because it was gotten from the orchard of Mr. CRANE of Fennville, found to be good, and the true name was not known. Mr. CRANE bought the trees for Early Rivers from some nurseryman who misnamed them. As to soil, gravelly loam is preferable, but the peach will do well on any well-drained high ground. The Elberta ripens soon after the Early Crawford.

Mr. SAMUELS: I have grown St. John twenty-two years and found it

exceedingly good; have received the highest price for it. I better like the quality of some other peaches; and it is not uniform in size, having a tendency to smallness and growing double. It has been called May Beauty, Flater's St. John, and Fleitas St. John. Elberta is light yellow in color, more oval than Crawford, and hardiest, in southern Illinois, of any yellow peach. It ripens with Late Crawford.

Mr. W. F. BIRD of Ann Arbor: Can any one tell about the peaches, Excelsior and Hine's Surprise?

Mr. W. A. TAYLOR: There are two peaches that have been called Excelsior. One was fruited by Mr. S. D. WILLARD of Geneva, N. Y., and is now called Hine's Surprise. One was sent to the department from Massachusetts, and is now called Crosby. This ripens just ahead of Late Crawford, is of medium size and shaped like the Barnard, but of lighter color and striped, J. H. HALE is introducing it. It is hardy.

Prof. TAFT: I knew the Excelsior at Amherst. It was liked there for its hardiness.

Following the discussion the secretary read the paper, by Wm. STAHL of Quincy, Ill., upon

SPRAYING FRUITS, WHY, HOW, AND WHEN TO DO IT.

My interest in spraying dates back to 1883. Then, as now, I was extensively engaged in buying and shipping as well as growing fruits. In that year I found it all but impossible to get grapes free from black rot, in the localities from which I had been shipping. About Quincy, for example, the crop was practically ruined by rot. That year I shipped grapes into Quincy from other localities.

For fifty years, Nauvoo, Ills., has been the center of a great grape-growing industry. Black rot appeared there in the sixties and some years had rendered the crop worthless. In 1883, I found the grapes in the vineyards on the bluffs and the uplands about Nauvoo, unmarketable by reason of rot, but on the narrow strip of sandy land between the bluffs and the river, I found grapes very nearly free from rot. For those grapes I got as high as two dollars per basket in the St. Paul and Minneapolis markets. They were so profitable to both the producer and the shipper that I could not escape the conviction that a remedy for black rot would be of almost incalculable benefit to the vineyardists of the country. I began experimenting, and my experiments included spraying with about everything I saw recommended, and with several mixtures original with me. None, however, gave valuable results. It is remarkable how little was known about spraying, how few appreciated its capabilities, and how rude were the available appliances, only eight years ago.

I first used the Bordeaux mixture in 1888, on a very small experimental scale. The results clearly justified continued and more extensive experimentation. In 1889 I sprayed with the Bordeaux mixture quite extensively, and the results showed to my own satisfaction that I had at last found the remedy for black rot. Those results also convinced others of the same fact. Hence, in 1890, I sprayed all my vineyards, and quite a

number of neighboring vineyardists sprayed their vines. The results were all that the most sanguine had anticipated.

The Nauvoo Rustler said editorially: "Those who did not spray this season have lost from 80 to 95 per cent. of their crops by rot, while those who sprayed did not lose more than from one to five per cent. The efficiency of spraying apple, peach, pear, plum, and cherry trees has also been established by experiments among our horticulturists, and hereafter the practice of spraying their trees will no doubt be general, as all concede that the secret of success has not only been discovered, but also demonstrated before their very eyes.

The past season we sprayed again, and of the results the editor of the Quincy Farmer's Call, who visited our vineyards the first week of September, said editorially: "We do not think we have ever before seen grapevines so heavily laden, and not one grape in a hundred was affected with rot; while only a short distance away, vineyards on the same soil and under like conditions, except that they had not been sprayed, were so badly affected with rot that their crops will not be worth gathering. In some vineyards a row or a part of a row through the middle had not been sprayed, as a test, and in every case the vines not sprayed were badly affected with rot, and the fruit will not be worth gathering; while on either side, the foliage of those sprayed was little affected, and they were heavily loaded with well nigh perfect fruit. We saw many other evidences that spraying is an effective, and the best, way of combatting the insect pests and fungous diseases of fruits. Undoubtedly the fullest plum tree we have ever seen was one that had never matured a crop before, on account of the curculio, etc. It was thoroughly sprayed this year and the result is what we have stated - an enormous yield of perfect fruit. We saw Damson plum trees that had been well sprayed, that were loaded down with fruit and holding perfectly, while other Damson trees near by, not sprayed were dropping their fruit so fast that very little will be matured. We saw the same phenomena exhibited by pear and apple trees. Certainly if we could take the farmers and fruitgrowers of this country to Mr. STAHL'S fruit farms, and show them the effects of spraying that we saw, every intelligent man among them would have a spraying outfit before another season, and would no more think of failing to spray his fruit trees and plants than he would of failing to cultivate his corn or potatoes.

Such is the testimony of everyone that has seen my fruit fields. I have letters from above one thousand fruitgrowers that have tried spraying the past season. I can not refrain from quoting from a few of the letters I have received from this state:

M. NELSON, Menominee, Menominee county: "I have sprayed my orchard of 1,000 trees, and I have not seen one wormy apple this season. One tree I sprayed four times, and have now picked twenty bushels from it—the only crop for four years."

H. E. POTTER, Whitehall, Muskegon county: "Sprayed my orchard of 100 trees; the apples are all perfect, when in former years at least one third would be wormy."

FRANCIS W. HALL, Sheridan, Montcalm county: "Have sprayed apple, plum, and cherry trees; have saved 50 per cent. of the apples. Cherries and plums were free from worms."

E. D. L. EVANS, Houseman, Oceana county: "We sprayed the Baldwin, Stark, Wagener, Ben Davis, and Greening apples, and also plums, pears, and cherries, all with excellent results. Our apples are of the nicest quality- large and smooth. Our orchard is the only one that has any fruit on it at all."

H. W. JONES, Houghton, Houghton county: "Have used your sprayer on 300 apple, pear, plum, and cherry trees this season, and have been greatly pleased with the results. Have also used it on my currant bushes, and never had prettier bushes. Have kept five acres of potatoes free from bugs, cheaper and more effectively with the sprayer than I have ever done before with other appliances."

These extracts might be multiplied until reading them would occupy hours; but I have certainly given already sufficient evidence that, by spraying with the proper outfit, at the right time, and using certain mixtures, we can protect our fruit trees, shrubs, and vines from insects and fungi. Naturally enough, those who have tried spraying speak only of the effect on the fruit, or at least make this effect so prominent that the effect on the tree or vine itself is lost sight of; but it is of the highest importance to understand that spraying secures thrifty, healthy trees and vines as well as perfect fruits. To have crops of fruits, we must have living, healthy trees and vines; and recent years have shown that, to have living, healthy trees and vines, we must protect them from a multitude of fungous diseases and insect pests. It is these that have proved so destructive in our orchards. Very many have not recognized the real cause, and have ascribed orchard fatalities to change of climate, to wrong location, or to the weakening of the plant or tree through the highly artificial conditions that have led to the increased fruitfulness of the tree and the improved quality of the fruit. One or more of these causes may have some effect; but greater in their effects are the insects and fungi. It is they that so weaken our trees and vines that rigors of climate or peculiarities of soil, that otherwise would have a scarcely appreciable effect, now destroy the thrift if not the very existence of our orchards. Note the effects of spraying with the Bordeaux mixture, for example, in a vineyard subject to black rot. This disease first attacks the vine, then the fruit. The use of the Bordeaux mixture can be detected at a considerable distance by the better appearance of the foliage. It is more vigorous, of a better color, perfect, showing plainly health and thrift. By using the Bordeaux mixture we get healthy, vigorous, thrifty vines and foliage, as well as perfect fruit. So in the apple, or cherry, or plum, or pear orchard, in the berry patch, or in the potato field, we get a stronger and a healthier growth by spraying. If nine of each ten that find their orchard trees dead by the time they are ready to bear, would use a spraying outfit wisely, they would find it yet possible, and easily possible, to have thrifty orchards, reasonable care and intelligence being used in other directions.

We have now had at considerable length the "why" of spraying; what of its "how" and "when?" At the best I can give only a few points about the "how" and "when," but they will be safe and good as far as they go, and will at least serve to demonstrate that spraying in all its parts is easy, simple, and inexpensive. Any one with sense enough to cultivate fruits can spray them. For the black rot or mildew of grape and pear. and quince leaf-blight, and potato blight or rot, use the Bordeaux mixture, which is made as follows: Dissolve six pounds of sulphate of copper in sixteen gallons of water. In another vessel slake four pounds of lime in six gallons of water. When this has cooled, pour it slowly into the copper solution, being careful to mix the fluids thoroughly by constant stirring. The water costs nothing, the lime costs next to nothing, and one hundred pounds of the copper sulphate will cost you only seven cents per pound. There is no danger in the mixing or in the use of this preparation. To spray the average vineyard will cost, per acre, for labor and material. per spraying, not more than one dollar. Without exaggeration, spraying has paid some vineyardists one thousand per cent.

But spraying will be of more general benefit when directed against the curculio of the plum and apple and the codlin moth and canker worm of the apple—those pests that have made the maturing of a plum crop an

impossibility, in many localities, and that cause so large a part of the apple crop to be wormy and to drop, but which may be destroyed by spraying with a mixture of one pound of London purple to one hundred gallons of water. Mix the London purple thoroughly in sufficient water to make a paste; then stir into a pail of water and allow to stand over night. Strain this through a fine sieve or a coarse cloth, into the distributing barrel or tank. This remedy is even cheaper than the Bordeaux mixture. The London purple costs twenty cents per pound. Fifty gallons of the mixture will spray an acre of orchard, and one man will spray ten acres of orchard per day. E. D. L. Evans of Houseman, Oceana county, Michigan, writes me that "We sprayed a ten-acre orchard between eight o'clock and three, and put eight barrels of solution on it. The cost of orchard spraying, per acre, per spraying, will not exceed, for labor and material, 25 cents per acre. This is certainly a cheap and profitable way of getting an apple crop where otherwise no crop, or at the best a very poor one, would be obtained; and by spraying we not only get perfect fruit, but keep our orchards healthy and thrifty.

There is one more important insecticide—kerosene emulsion, for hop lice, squash bugs, leaf hoppers, aphis, bark lice, etc. I prepare it by dissolving one-half pound of hard soap—only the best whale-oil soap should be used—in four pints of water, by boiling. When the soap is all dissolved remove from the fire and add eight pints of kerosene and agitate the whole briskly until a stable mixture is formed. This is best done by using a force-pump and pumping the mixture with force back into the vessel that contains it. The emulsion may be diluted to the desired strength and used at once, or it may be allowed to stand and be used when needed. The strength ordinarily used is prepared by diluting one part of the emulsion with ten or twelve parts of water. It will be seen that the cost of this is, like that of the other insecticides, really insignificant. In a ten-times dilution—full strong for ordinary purposes—of 240 pints or 30 gallons, we have one pound of whale-oil soap, which costs 15 cents, and 15 pints or 2 gallons, of kerosene, cost 25 to 30 cents. It will be seen that the cost is little more than one cent per gallon.

To destroy the canker worm, codlin moth, or curculio on apple trees, spray soon after the blossoms fall—when the apples are the size of a pea—and again in a week or ten days. To destroy the plum curculio, spray the trees three or four times, at intervals of a week or ten days, beginning as soon as the blossoms have fallen. To prevent leaf-blight of pear or quince, spray every three weeks until about August first, beginning in March, when the leaf bud has not yet unfolded. Five sprayings are usually fully sufficient. For black rot of the grape, begin after the vineyard has been pruned and put in order, but before vegetation starts, spraying thoroughly, spray again about ten days before the flowers open, the third time when the flowers are opening, and from that on every three weeks until the fruit begins to color—say five or six sprayings in all.

You can now compute easily how much it will cost you to keep your vines and trees free from disease and insects; what a trifling expense is necessary almost to insure you thrifty orchards and vineyards and large yields of perfect fruits. It may truly be said of spraying that the benefits are out of all proportion to the cost. When we consider how palatable and wholesome, how altogether desirable, are the fruits of the tree and of the vine, how favorable to the development of the best elements of human character is the tending of the orchard and the vineyard, surely we are

convinced that if "he who makes two blades of grass to grow where but one grew before" is entitled to the world's blessing, he that sprays wisely and well is "greater than he that taketh a city."

OTHER MEN'S VIEWS OF THE SUBJECT.

Mr. Bird: There seem to be different ways of making the Bordeaux mixture. Some pour in the lime and some strain it.

Mr. Stearns: Probably 100 or 1,000 persons will spray next season to one who did so this year. The best results will be to those who "get there first." The most important point is to be early about it. Pulverizing the lime facilities the slaking and mixing, and hot water on the sulphate of copper acts quicker than cold; and it is best to strain the lime water through burlaps or other coarse fabric, or trouble will be had with it in the pump. Care must be taken to keep the pump clean. I have used Mr. Stahl's formula, but four pounds of sulphate of copper is enough —some of the bulletins say so, and that is my opinion.

Mr. W. A. Taylor: The board of health of New York city condemned a lot of grapes last fall because of the appearance of copper stains on the stems, and their action for some time hurt the sale of all grapes. An agent of the agricultural department found that the condemned grapes were grown by a farmer who had sprayed every week and used a broom with which to throw the liquid. The condemned grapes were dangerous; but when the correct formula is used, a man would have to eat three tons of grapes before he could receive enough to endanger his health. There is no danger whatever, but much less copper may be used. At Charlottesville, Va., a solution of only two to three pounds was highly successful, even where there was much disease.

Mr. McArdle asked Prof. Taft if kerosene oil could not be used in some way to kill squash bugs; and was told it would scarcely be posssible to make a mixture of oil strong enough to kill the bugs and not also kill the vines.

Mr. Bird: I have tried kerosene oil for this purpose and was successful; but it was hard to say which was deadest, vines or bugs.

Mr. Stearns: There is no danger of injury of foliage from use of the Bordeaux mixture, but care must be exercised with the arsenites. I would not use arsenic upon pear or plum trees, except with Bordeaux mixture, one pound of Paris green to 300 gallons of the mixture. Using this, my plums did not rot while those of others, not so treated, did rot. I sprayed my plum trees before the leaves opened, and immediately after their opening, and at succeeding times, once each week or ten days. I

prefer Paris green to London purple because it has proved less harmful to foliage.

Mr. J. F. TAYLOR: Some years ago I hurt the foliage of plum trees by use of Paris green. But in view of the success of Bordeaux mixture upon grapes, I this year added Paris green to it and sprayed my plum trees when the fruit was the size of peas, and again a week later, and had no rot; but there was not much rot on anything this year. I used Bordeaux mixture three times on sweet cherries and there was scarcely any decay. I then took the lime water, strained, and to 200 gallons of it added one pound of green or purple and put on peach trees and no harm ensued. I find no difference between Paris green and London purple when used with lime water. I feel safe as to hurting the foliage with either. I used very little Paris green and cleared cherry trees of slugs at a single application.

Mr. HAWLEY: I use and find effective, simply the dust of slaked lime for slugs on pear, plum and cherry trees.

EVILS OF PREVAILING METHODS OF SELLING NURSERY STOCK.

Under this title Mr. ROLAND MORRILL of Benton Harbor, read the appended paper:

In preparing a paper on this topic I must confess I am at a loss as to whether it should be called the evils of present methods of selling or of purchasing nursery stock, but we all know that there is something radically wrong in the business, as the cry of disappointment comes to us from every quarter, and it does seem as if the matter needs a little airing.

The trouble seems to arise both from the cupidity and "cussedness" of some of those who grow and sell stock, and from the ignorance and indifference of some purchasers. A combination of both invariably results in serious loss to somebody, and either one or the other may result in disaster. We will in the first place state that we consider good, reliable nurseries as absolutely essential to the fruitgrowing industry, for we have no faith in the ability of most men to grow their own stock, although some men advocate such a course. We would far better leave that part of the business in the hands of the trained nurserymen, where it properly belongs, as a matter of expediency and economy; but when he introduces methods of doing business which result to our disadvantage, it is time to call a halt, for he depends on us for a reward of his labor, and our success or labor depends largely on his integrity and skill.

So we will first call attention to certain wrongs which he often perpetrates on us; and then to methods by which he assists other people to swindle us outright. First, we will call attention to the substitution clause found in most nursery catalogues, in which the nurseryman claims the right to fill our orders with varieties other than those ordered, in case he does not happen to have the variety ordered. Now, just think what an outrageous proposition this is, anyway. Suppose, for instance, you order a thousand Baldwin apple trees, and he has a large stock of Greenings, and fills your order with them. How would you like that? Of course you can forbid substitution, but right here our ignorance and indifference

comes in. Most men never see the clause until they have had some sorrowful experience. Now, I would like to know what moral or legal right a body of nurserymen have to meet and adopt such a rule to govern us? As well might our grocers adopt such a substitution clause in their trade. Then, if we order sugar, send us salt if they happen to be out of sugar, assuming that they know what we want as well as we do ourselves. This, and the practice of working a certain amount of old and stunted stock into the younger grades, are perhaps the worst features of the business, as far as the deal direct between the nurserymen and ourselves is concerned. But I presume not more than one fourth of the stock sold in this state is sold in this manner. Much larger quantities are sold by agents and dealers, and we wish to call particular attention to the antics of some of these gentlemen.

Many of these large nurseries employ a large number of agents, and we often see the advice printed to purchase only of agents who carry the credentials of a reliable firm. Suppose we follow this advice and demand a showing of papers. We find our agent is armed with authority to represent one of the largest nurseries in America, so we buy of him, paying him two or three times the value of the stock, as we find him provided with most beautiful colored plates and lists of just the stock we want. In our innocence, we think now we have done just the right thing, even if it is a little expensive. But there is one thing that this nice agent for a reliable nursery did not show us. That is his contract with said nursery, in which it is agreed that they will not be bound to furnish exactly the grade or variety ordered, but will adhere as closely as convenient to his orders. Still you have signed an order in which you have agreed to pay full price for the trees on delivery, and may not get what you buy at all, and you are much worse off than in the first instance, as there is a third person between you and the man who should be responsible. This method of imposing on the public originated with the nurseryman; and why should not the public adopt a rule that in case they are out of cash when the trees arrive, they reserve the right to pay for them by an equivalent in butter and eggs (stale eggs if the trees are not true to name)? The most rascally method of selling trees that I know of is the practice of furnishing a "billing ground" for dealers. Do you all know what that means? It means just this: that a dealer can canvass a large territory, selling all kinds of fruit trees to you and your neighbors, and not own a single tree. Now then, after collecting all the orders he can, he goes in the spring to one of these nurseries and purchases enough trees to fill his orders, getting the cheapest he can that he thinks will fill the bill and pass inspection. Nearly all nurseries have a certain amount of well-grown trees of unsalable varieties, every spring, which they are glad to sell our dealer at any price, and will furnish him a "billing ground" and all the boxes, labels, and packing material he may need—at the same time the nurseryman certainly knows that he is furnishing the dealer the means of swindling a lot of ignorant farmers, and the very fact that he has made the operation so convenient accounts for the immense amount of this swindling business that is being done all around us.

This scheme was also a nurseryman's invention; or rather, has been the natural outgrowth of the business. Of course I am aware that the everlasting hunt for cheap trees, by farmers, has in a certain measure compelled the nurseryman to sell so low that he must sell all his stock at some price in order to live and do business like other men; but a man with a

good conscience would quit a business which compelled him to be the chief assistant to a boss swindler, for a paltry sum of money, and I am pleased to know that some of our best nurserymen will not do any business of this kind, but prepare to burn large quantities of well grown stock along with their culls every spring, rather than swindle their customers by any of these methods.

I hope I shall not be misunderstood in this matter, as I do not wish to say anything disrespectful of any honest nurseryman; but when we look around us, or call out the experience of our neighbors, we find that a large majority of the trees set in the state, by our farmers, prove very disappointing, in a manner that points to the nurseryman, his agents, or his accomplice, the dealer, as the guilty ones.

One instance near my home is the case of one of the original members of this society who has an orchard of 1,500 peach trees, containing 500 bought for Crawfords, from one of the largest and most reputable nurseries in the country; but they proved to be a small "cling," so late that they have only ripened one year in three. This order was evidently filled under the substitution clause. In my own case, the first 200 peach trees in my orchard only contained twelve trees of the varieties ordered—balance substituted, to my loss; yet I ordered these trees of a nursery at Toledo supposed to be reliable, and the order forbade substitution. The next lot of 1,700 trees was bought more carefully, in this state, and there was no substitution, and there are not more than twenty trees that are not true to their name; but I purchased them of men whom I knew to be honest.

One of the worst deals I know of occurred in the town of Bainbridge, Berrien county. Two dealers, having secured the confidence of the farmers, sold nearly all the trees planted in the town for three years, by selling them well-grown stock. The past season the three and four-year old trees came into bearing and the yellows commissioner of that town informs me that not one tree in ten proves true to name. There are about 100,000 trees, and the loss must amount to hundreds of thousands of dollars, many of the orchards being remarkably thrifty and well grown, but practically worthless. Neither of these dealers have attempted to do any business in that town for the past two years, one having quit in favor of a county office, the other following the same business south of here.

But all dealers are not rascals, as there was another in the same township, a prominent farmer, and ex-member of our legislature, who attempted to "fill in" his winters by selling nursery stock, and so far the orchards sold by him have turned out remarkably well.

I mention these local matters simply as samples of what is going on all over the country, from which the aggregate loss amounts to millions of dollars annnally. One peculiarly noticeable fact is that this trouble is least in pear stock, next in apples, and greatest in peaches and small fruit, which would indicate that substitution was practiced largely according to the ability of farmers and growers to detect the fraud by the manner of growth, color of bark, etc., of the stock furnished.

Now, perhaps you infer that I consider the nurseryman alone in fault for this state of affairs. Not at all. I have simply pointed out the things which he should not practice. A very large proportion of our fruitgrowers, by their ignorance and indifference, are partially responsible for this state of affairs, as they are considered the legitimate prey of this class of sharpers. If you don't believe this, look around you and select your most successful commercial fruitgrower, and you will find that he has not made

his success by accident. Almost invariably he is a shrewd, clear-headed man, who would succeed in other business just as well, because his success is the result of well-matured plans, perfectly carried out in all their details. For instance, if he finds that he has a good soil and market for Bartlett pears, he does not let some agent convince him, by the aid of beautiful plates, that he needs a dozen kinds, or that he wants something else. On the contrary, he learns, if possible, where he can get the best Bartlett trees from a reliable nursery, is willing to pay what they are worth, knowing very well that when he commences to beat down on prices he is getting upon dangerous ground; and generally he will get better stock for the same money than his close-fisted but ignorant neighbor, who prides himself on his ability to drive close bargains, as the nurseryman will recognize in him a good customer, and will be careful to satisfy him. This stock will prove good; his crops will be excellent, and his prices "way up." Some of his neighbors will call him a lucky man, as the easiest manner of explaining the difference between his success and theirs.

I have said many harsh things, made some unpleasant comparisons, and still it is not half told—but enough to call your attention to these things, and each one of us must study out the remedy in his own manner. You may think that I believe all nurserymen need watching, and that all agents and dealers are rascals. But not so. I do know several dealers and agents who are honest and reliable gentlemen, who are doing good work; but it takes years of acquaintance to determine this. Nurserymen average as honest as men in any other trade, many of the leading ones being thoroughly reliable and valuing their reputation above all things; but some have introduced methods, as stated, that work to our injury, and we must protect ourselves by studying the details of our business more closely, learning what we want and how to get it; to do our own business instead of letting the job to the highest bidder; in short, to fit ourselves for the business before we go into it, or else go in moderately until we know by experience what we want, for one of the first things we have to do is to lay the foundation in the purchase of nursery stock, and a mistake made here may be a source of regret as long as we live, while correct plans properly carried out will lead to prosperity and happiness.

Mr. Morrill was followed by Mr. A. Wyckoff of the Albaugh Nursery Co. of Dayton, Ohio, with this brief paper:

The general plan of disposing of nursery stock is through dealers who buy their stock of nurserymen at wholesale, usually carry the catalogues of nurserymen of whom they buy, make their own selections of varieties and grade of trees, label the same to suit themselves, and in fact, outside of growing the stock, the nurseryman is "not in it." Hence, stock often proves to be inferior, cheap grade, poorly packed, and, worst of all, varieties largely or wholly untrue to name.

The remedy is for nurserymen to employ salesmen direct; to have a constant oversight of the selling; to know constantly, by the sales being reported weekly, with the varieties, how the the sales of varieties are going, and knowing thereby, exactly, if he can furnish the varieties sold.

Also, the purchaser should have from the nurseryman (not from the salesman), a legal guaranty of the correctness of the varieties named. Even after the salesman has quit business, changed employers, or gone to that world where all good tree-men go, with this last method the planter has absolute protection, but with all other plans, none at all.

The protection given by this method is even better than buying from the small, local nurserymen, who often have not, and can not keep, the new and valuable varieties, and who, if they have much trade, must buy largely of other nurserymen.

The only protection a planter can have is by a legal, written guaranty from financially responsible parties. Verbal promises are worthless in the future when the trees come into bearing.

THE NURSERYMEN AND A TREE AGENT HEARD FROM.

Mr. NELSON BOGUE of Batavia, N. Y.: There are many things in Mr. MORRILL'S paper which are a delight to me and many things for which I am sorry - regretful that people have to put up with them. The buyers of nursery stock are largely to blame, for they have ample time in which to inform themselves of the character of all nurserymen, for their true character and reputation are easily to be ascertained. But for these impositions there is really no justification. There is a wide difference between even the leading nurserymen. Some travel in foreign countries, going to their utmost bounds to learn of varieties, cultivation, and other methods of treatment, attend such meetings as this, correspond extensively and undertake to do exactly as they agree. When people are imposed upon, it is often by a man claiming to represent a responsible house but who really does not. If you wish to know the standing of some nurseryman, write to some reliable man you know and who knows the party about whom you enquire. The substitution clause is subject to grave abuse by dishonest persons, but an honorable nurseryman may, and often does, use it for the great benefit of ignorant purchasers who order what by all means they should not have. I substitute both with and without correspondence with the customer. The clause should not be so severely condemned. If a buyer does not want it in his contract he should erase it.

Mr. TRACY: I was once visited by a plausible talker who claimed to represent an eartern firm of nurserymen whom I knew to be reliable. He offered such stock as I wanted, and an order was made out. But instead of giving it to him, I refused to sign it and said I would mail it to the firm but leave to him his commission on the order. This the peddler would not agree to, and he was never found again in that community. Before condemning dealers and nurserymen too severely, buyers should more carefully investigate before placing their orders.

Mr. RICE: We have heard from the farmer and the nurseryman on this subject, and now it is time for the middleman to speak. I am he. Much of the trouble comes from a certain class of agents, uneasy young fellows who go to selling trees from lack of anything else to do, who really know nothing about the business of fruitgrowing, and who strongly recommend

varieties that are usually not good for anything. They are instructed to urge these, to show the attractive pictures to the women, and are told by the nurserymen: "Sell three 'specials' each day and you make your wages. All the rest is profit to us." I once went to a nursery with an order for peach trees. I saw them dug, labeled and tied up; the nursery rows were all nicely labeled with stakes; but what did the purchaser get? He don't know, and I don't know, except that in the whole lot there are two Crawfords. On the other hand, I once went after Shropshire Damson plum trees, but got something large and fine and much better than Shropshire Damson. There's your honest nurseryman! We agents may try to do our very best, but for most of the troubles you nurserymen are to blame.

Mr. BIRD: The remedy lies with the experiment stations if we have enough of them and they are rightly conducted. They can test new varieties and prove their value.

Mr. STEARNS: I class myself as a fruitgrower; but for years I was a nurseryman, and I will back nurserymen for honesty and integrity, against any class of men, and none, unless it be bankers and railway men, are more vigilant to guard against mistakes. True, they try to find out what varieties of fruits are wanted and to supply them. An honest man may go forth to sell fruit trees and be unable to sell twenty-five cents' worth, while the offerings of one who has a plum that curculio won't touch will be snapped up.

Mr. BOGUE defended the nurserymen in their efforts to introduce new varieties, citing as examples Ellwanger & Barry with Industry gooseberry and Mills grape. If they had waited for results at experiment stations it would have been years before these excellent fruits had become known. True, there are many places where the industry does not succeed (as in the case with other fruits) but there are many other localities where it is highly successful. When such specialties are bought it is on the basis of their successful growth by the introducer and not otherwise.

President LYON: I have never bought a tree from an agent and I never will buy one. If I want any stock, I find where it may be had and go directly there. Then, if it is not all right, I know to whom to go about it. Whoever buys of an agent must expect to pay two or three times what the same article would cost at the nursery.

Wednesday Evening Session.

This session was most largely attended of all, several hundred persons being present, entirely filling the hall. After an introductory piece of music, Chairman GARFIELD introduced Hon. J. M. SAMUELS, Chief of the Division of Horticulture, who spoke as follows upon World's Columbian Exposition.

HORTICULTURE AT THE WORLD'S FAIR.

In attending this meeting of your State Horticultural society, I do not feel that I am coming among strangers by any means. The names of many of you, whom I have met, are quite familiar. I have been in many parts of Michigan, and mingled with the fruitgrowers so often, that I feel almost as much at home as in my native state.

As you are aware, my appointment has recently been made. Upon being confirmed, I found the plans of the Horticultural Hall had been decided upon, contracts given for most of the work for building, and the location properly determined, but nothing more. Out door space for trees and plants had not been considered, and in the general scramble for additional space, by the heads of the different departments, every available foot of land had been appropriated, except a small area between the building and the lagoon. This seemed discouraging for a beginning, and I came to the conclusion at once that it would be necessary to act with promptness and vigor before plans had developed too far to admit of being changed.

By persistent effort we have suceeded in having assigned to the department all of a beautiful elevated island, containing fifteen acres, and around which are clustered most of the great buildings of the Exposition. The view, from every part of this island, will be the grandest on the grounds, and in some respects will not be equaled in the world. Adjacent or near to the horticultural building, an additional ten acres have been secured. making about twenty-five acres of out-door space altogether. The island, upon which has been spread the black soil removed from all the building sites, mixed with a liberal supply of fertilizing material, will be used for an exhibit of roses, rhododendrons, azaleas, herbaceous plants, and a general nursery display. The planting immediately in front of the building will consist of echeverias and other bedding plants, arranged in raised beds and made to harmonize with the ornamental frieze which extends all along the front of the building. The beds will probably be illuminated with 30,000 or 40,000 incandescent electric lights, requiring 1,000 horsepower to operate them. And these lamps will show the complete outlines of every bed, and be placed under foliage, and colored in a way to bring out the most spectacular effects. They will be operated to show portions of the beds at one time, or different parts in rapid succession, and thus present an attractive panorama or kaleidoscope. Other parts of the outside grounds will be illuminated in various ways. The horticultural building is the finest ever erected for a fruit and plant exhibition. It is 1,000 feet long by an extreme width of 237 feet. As you will notice from the engraving, it has a central glass dome, connected by front and rear curtains with two beautiful end pavilions, thus forming two interior courts, each 89 feet by 287 feet.

The roof of the front curtains will be glass, and they are intended for the tender plant exhibit. The rear curtains have opaque roofs, except sufficient glass to give an abundance of light for the fruit display. For heating the dome alone by steam, it will take ten miles of $1\frac{1}{4}$ inch pipe, besides an additional amount for the front curtains. There are 59,631 square feet more of floor space in the hall, than in the combined horticultural buildings at the Centennial, New Orleans, and Paris.

The dome is 187 feet in diameter and 113 feet high on the inside, and to overcome the dwarfing effect on plants, that would evidently be produced by its immensity, it is intended to construct a minature mountain under its center, 40 feet high and 70 feet in diameter, and upon the sides and top of this artificial rock-work, to set the largest specimens of palms, bamboos, tree ferns, giant cacti, etc. Some grand examples, 40 feet in height, have been donated for this purpose. Among this mass of exquisite foliage, will be represented, by the use of incandescent electric lights, the forms and tints, in colored glass, of flowers rarely seen in this country. Over its sides, will fall in translucent sheets and ripples, the water for a beautiful cascade, while the interior will form a cave, from the crystal side of which will be reflected the brilliant lights of thirty electric arc lamps of 2,000 candle-power each. In recesses and for special effects, incandescent lights will be placed within the cave, in order to observe the effects and to test the endurance of different species under such conditions. It is hoped to arrive at some definite and valuable conclusion by this experiment.

In one of the courts of the building, basins will be made for exhibiting Victoria Regia, nymphæa, and other rare aquatic plants. Incandescent lamps will be arranged under the water to show effects not heretofore attempted. In the other court, California and Florida will compete for honors, with bearing orange groves. The former state will illustrate the manner of irrigating their orchards, and the latter will intersperse bananas, pineapples, and other semitropical plants, often cultivated in connection with the groves of that state.

The balance of the building will be devoted to collections of orchids, crotons, cycads, dracænas, aroids, and rare plants from every part of the world, and to the fruit display.

Space for at least 60,000 plates of fruit will be reserved for the grand display which will take place in September. In this exhibit, it is intended to keep out of the beaten paths of former expositions, and adopt some new methods. Long tables, with straight rows of fruit, are too monotonous and will be avoided. It is intended to have the receptacles for the fruit made in artistic forms of papier-mache, and supported in unique ways.

The exhibit will be embellished with flowers and plants and made more attractive by miniature representations of orchards, methods of cultivating, irrigating, etc., in mountains and on plains, in tropical and temperate climates. Wax models of fruits out of season, and of those too tender to transport from distant lands, will illustrate, in form and color, at least, specimens unfamiliar to most of the visitors who will attent the Exposition.

Experiments will be made with glass cases through which condensing refrigerator pipes will be run, and the temperature kept at a proper degree to preserve, as long as possible, berries and other perishable fruits. The difficulty in the successful operation of this plan may be the condensation of moisture on the glass sufficiently to obscure the view. It is said, however, this can be obviated by making the glasses double and leaving some space between them.

In one of the pavilions the general seed and horticultural appliances display will take place; in the other pavilion the viticultural exhibit will be confined. These will be separated from the other displays as completely as if they were in a separate building.

The classification is very elaborate and embraces almost everything of interest to horticulturists. Here may be seen fruits and plants from every part of the world, the best methods of heating and ventilating greenhouses; grafting, pruning, and spraying trees and vines; machinery for gathering and marketing fruits; and for assorting, cleaning, arranging, labeling, and testing the vitality of seeds.

It would take too much of your valuable time to give in detail the full scope of the department.

Mr. JOHN THORPE of the floricultural bureau is now in the east, and is instructed to visit every prominent conservatory and make a complete list of all the fine plants that will be donated, loaned, or exhibited for competition, with a view to having one or more men start, about the beginning of the year, to the West Indias and Central and South America, to collect large specimens that can not be secured in this country. Directions for collecting, packing, and forwarding plants from foreign countries have been translated into several languages and widely distributed.

Many intending exhibitors of fruits and plants, in this and foreign countries, have made application for space, or, with a view thereto, are corresponding with the department.

The management, with the aid of the heads of the other departments, have strenuously opposed all cash premiums, and it has therefore been more difficult to convince the authorities that an appropriation was necessary for that purpose. In my report to the committee on awards, of the national commission, and the agricultural committee of the local directory, I made the following statement:

"Believing it will result in economy to the Exposition management, besides being an act of justice to a certain class of exhibitors, and also create a superior exhibit, I would recommend that an appropriation of $45,000 be devoted to cash premiums. No manufacturer of any horticultural appliance, or any person or corporation who could be greatly benefited from advertising a business, should receive a cash premium. On the other hand, the exhibitor of fruits and plants, who makes collections at great cost, pays freight and express charges, is protected by no patents, and receives no special benefit, and finally loses everything at the close of the Exposition, should be reimbursed for some of his outlay. As a prize that would be offered amounts to a very small per cent. of the value of the article exhibited, it seems to me it would be a wise policy to induce the owners of meritorious specimens to offer them for competition, rather than be compelled to purchase for account of the Exposition. Some of the rarest and most beautiful plants could not be bought or borrowed, and the only way in which they could be secured would be to offer competitive prizes."

Both committees and Director-General DAVIS have recommended the appropriation, which practically insures its passage. This amount will be sufficient to secure a magnificent display.

Michigan, with her unsurpassed horticultural resources, well-known enterprise of her citizens, and her proximity to the World's Fair site, is expected to and should make one of the best and most extensive displays. The grand old man who is at the head of the Columbian Commission, the

worthy chief of the department of livestock, and others from your state which has been honored more than any other, except Illinois, by representation in the Exposition, expect Michigan to take the lead in the horticultural exhibit; and I will be greatly disappointed if you do not fully equal any other state.

MR. BELDEN SPEAKS FOR MICHIGAN.

The Chair then introduced Hon. EUGENE BELDEN of Jackson, member of the Michigan Commission on the World's Columbian Exposition. Mr. BELDEN said: I am here by the authority of the board of managers to confer with you on the subject of our exhibit at the World's Fair, and I have been much gratified to note the interest which is manifested here upon that subject. Now, the main question is, what can be done by your society to aid in making this exhibit. In the first place, the amount of money at the disposal of the commissioners is but $100,000, which is but one third the amount it should have to make a satisfactory exhibit. While therefore the commissioners are very anxious to make a fine show, especially since we are so near Chicago, they feel that they are unable to do what they would like to do. The board of managers at the outset was applied to by many persons proffering their services for large pay. We found that if we began upon that plan and employed men to assist in this work and paid them the amount they desired, the result would be that we would soon exhaust the appropriation without accomplishing results commensurate with the outlay. We first resolved, therefore, to employ no one under pay, but to ask the people of Michigan to prepare the exhibit without compensation, and therefore I have sought to map out the work so that each individual would have very little to do. In the first place, county committees have been appointed consisting of three or more members, according to population; and in addition we have provided special committees, not confined to any locality, who are to look after horticultural subjects. For example, there is one on horses, another on cattle, another on grains and grasses, and another on pomology, etc., making something like six hundred men upon these committees. This has been done for two reasons: First, because the appropriation is limited; and, second, because if we start out to employ men for special work many would want employment and at large pay. It has been found that the men appointed very generally accept the position with the understanding that there is no compensation.

With societies it is different. It is expected that societies like this will be aided in making this collection, but to what extent this can be done, I am not prepared to say. I am here to learn the desires of your society, that I may be able to report to the board at its next meeting. There

has been a committee on pomology appointed, and it is desired that this society recommend additional names for localities not now represented on this committee.

In regard to the manner of collecting this exhibit and placing it on exhibition, we must learn as we go along. The committee on grains and grasses is expected to establish headquarters within the state, to which all material intended for exhibition will be sent, where it will be classified and prepared for sending on to Chicago. With fruit, however, it will be necessary to have them sent directly to Chicago and to have members of the committee there to receive it and place it in position. This will necessarily involve some expense. I should like to get an expression from you of about how much would be necessary for that purpose.

VARIOUS POINTS COVERED BY DISCUSSION.

E. H. Scott, Ann Arbor: I would like to hear Mr. Garfield's opinion as to the amount necessary to collect this exhibit.

C. W. Garfield, Grand Rapids: It would depend upon circumstances. If there is to be a pomological committee, to work distinct from the society, the work of the society will be so much reduced. If, on the other hand, the gathering of the fruit, flowers, and vegetables is to come through the society, it means another thing. I should want to know how much the society should do distinct from the committee. How does the committee intend to utilize the various organizations of the state in connection with this exhibition work?

Mr. Belden: There are three committees which cover the ground of this society, those on pomology, floriculture, and horticulture. My idea would be that the committee on pomology, as selected by the board of managers, with any addition which may be made, would have charge of the subject and that the State Horticultural society should act with the committee in any way thought best.

Mr. Samuels: It seems to me that the best plan for the state board would be to appropriate a certain amount of the appropriation and turn it over to the State Horticultural society with which to make the exhibit. This was done in Colorado, and that state is the first to report progress in fitting up its exhibit. That state has not only made application for space, but has already prepared wax models to be used in making a complete exhibit of the fruits of the state. Wisconsin has adopted the same plan, and $15,000, one tenth of the state appropriation, has been placed at the disposal of the State Horticultural society with which to make its exhibits.

C. J. Monroe, South Haven: In view of the fact that the state board

have appointed a committee to take charge of the pomological exhibit, how would it answer for the society to be present in some capacity at the next meeting of the committee and thus present its views of what seems to us should be done to properly represent the horticultural interests of Michigan at the exposition?

Mr. BELDEN: I intended to have spoken of that, and I think I can extend on behalf of the committee, an invitation to representatives of your society to meet with the committee at the next meeting of the board on the first Tuesday in January, at Grand Rapids, and there present the case. There has been nothing said about considering this meeting but it would undoubtedly be in order.

Chief SAMUELS: I would suggest that this society recommend that a certain amount be set aside for the horticultural exhibit.

W. W. TRACY, Detroit: If it has not already been done, I would move that the executive committee of this society appoint a committee for the World's Fair, and that this committee canvass the matter of the amount of money necessary for this purpose and that this committee be given power to act for the society in regard to accepting the invitation to meet with the committee of the board, and ask for the amount required.

J. F. TAYLOR: How will the committee of our society act with the committee appointed by the World's Fair board?

Mr. BELDEN: The board divided up the work among its members, each member selecting the special committees in his department, and the local committees, so far as possible. I was not particularly acquainted with the members of the State Horticultural society, and I made the selection as best I could, and I now wish your society to suggest additional members.

The county committees are expected to assist the special committees, and to take charge in their own localities of such matters as are not delegated to the special committees.

W. W. TRACY: It seems to me there is danger of Michigan falling behind in its exhibit if its preparation is in the hands of diverse parties, and if the experience possessed by the State Horticultural society is not available.

C. J. MONROE: I would be very glad, as a member of the executive committee, to have the amount needed for the horticultural exhibit talked over here to-night, and I think the other members of the committee will agree with me. It has been suggested that $20,000 would be used for an administration building, and perhaps $15,000 more for expenses connected with making the exhibit, leaving $65,000 for collecting all branches of the exhibit within the state. Now it seems to me that we stand on different ground from most of the industries of the state. The manufacturer may

have his agent at the fair and take orders for his goods, so that his exhibit may be of much direct profit to him. The same is true with owners of fine stock. It is different with the horticulturist. His exhibit will represent small interests widely scattered over the state, and each individual will derive little or no direct benefit from his labor in collecting and caring for his exhibit, which in every case will be a total loss at the close of the exposition. So I think it must be agreed that we shall have to do a great deal of voluntary work without direct benefit, to do the state credit in this department, whatever may be the appropriation for this work. Chief SAMUELS has a right to expect the state of Michigan to take a leading part in the horticultural exhibit. Chicago receives and distributes more horticultural products than any other city in the world. It is our own chief market, and the people of Michigan can reach that city quite as readily as those of any other state, not excepting Illinois. I feel therefore, that it is due from Michigan to make very extensive preparations for the fair. It seems to me, therefore, that if the committee already appointed on pomology could go before the board at its next meeting and say that this society had asked for a certain amount to cover the horticultural exhibit, it would help the committee in its work.

Mr. BELDEN: While I am interested in having the agricultural and horticultural interests represented as well as possible, at the same time I realize that the appropriation is small and that there are a large number of departments that will be clamoring for aid. There are several points to be considered as a basis upon which to make an estimate of the amount which should be set aside for the horticultural exhibit. The fruitgrowers of Michigan will not only be largely benefited by their exhibit in the way of extending their market, but there will probably be an appropriation of $45,000 made by the fair for distribution as premiums in this department.

W. W. TRACY: It seems to me it would be utterly impossible to make any estimate now of the amount necessary to properly represent the state. I think the committee proposed by this meeting should go before the board with a well considered plan of what should be done and ask or insist that a proper amount be appropriated to carry it out. The committee can not be otherwise than hampered in the preparation of such a plan by any expressions of opinion that could be here made by the society.

The motion as made by Mr. TRACY was then unanimously carried.

SELECTION OF VARIETIES OF VEGETABLES FOR SPECIAL PURPOSES.

A paper under this title was read by Prof. W. W. TRACY of Detroit as follows:

First, What is a variety? The orchardist considers that all the trees or parts of trees which have their origin, as far as bearing wood is concerned, in some particular single seedling, make up a variety, and all these trees or parts of trees of any given variety are in effect a part of the original seedling and are identical with it in all their limitations and possibilities. There may be great variation in different orchards, of a variety, or even in different trees of the same orchard, but this variation originates in conditions of health and nutrition and not in inherent differences of character. Nothing can change in any of these the character which existed in the original seedling, of which they are virtually a part; and a description of a variety so propagated is simply a statement of the character of a certain individual. In the case of a variety propagated by seeds, the case is not essentially different. Then we mean, by a variety, any collection of plants which so resemble each other as to be practically identical and which exhibit some common peculiarity which distinguishes them from other plants of the same species. A description of the variety, in this case is simply a statement of a certain standard, an ideal, to which a plant must conform in order to be included in that variety. It will be seen that there is a wide difference in the real meaning of "variety" in the two cases. One is an individual with all its limitations and possibilities of development; the other, simply a collection of similar individuals which conform to certain ideals. The character of one is fixed—we can never take away nor add to that which it was from the beginning, but only add to our knowledge of it and to our accuracy of description; but in the other case we may gradually change an ideal until it is radically different from that with which we started.

How can this selection of similar plants be secured? Practically it must be done solely by resort to the principle of heredity, the law that "like begets like." Those who have not studied the matter have little conception of how powerful an influence this is in the shaping of the character of all living organisms. Dr. HAMMOND gives the following illustration of its working in the human family:

A gentleman informed me that his grandfather had become accustomed to wake up from sound sleep at twelve o'clock every night and drink a cup of tea, after which he would lie down and sleep quietly till morning. The father of my informant was a posthumous son, and his mother died in childbirth with him. He was English, and at an early age went to India with an uncle. One night, when he was about twenty years of age, he awoke suddenly with an intense desire for a cup of tea. He endeavored to overcome the longing, but finally being unable to sleep, got up, and, proceeding to an adjoining room, made himself a cup of tea, and then, going back to bed, soon fell asleep. He did not mention the circumstance at that time; in fact, it made no strong impression on his mind; but the next night the awakening, the desire, and the tea making were repeated. At breakfast the following morning he alluded to the fact that he had twice been obliged to rise in the middle of the night and make himself a cup of tea, and laughingly suggested that perhaps it would be as well for him in future to have the materials in his bed room. His uncle listened attentively, and when the recital was finished, said:

"Yes, have everything ready, for you will want your tea every night; your father took it at midnight for over twenty years, and you are like him in everything."

The uncle was right. The midnight tea-drinking became a settled habit. Several years afterward the gentleman returned to England and then married. Of this marriage a son—my informant—was born, and six years subsequently the father died.

The boy was sent to school till he was sixteen years old, when he was sent to Amsterdam as a clerk in the counting house of his mother's brother, a banker of that city He was kept pretty actively at work, and one night in particular did not get to bed until after twelve o'clock. Just as he was about to lie down the idea struck him that a cup of tea would be a good thing. All the servants had retired, so the only thing to do was to make it himself. He did so, and then went to bed. The next night he again had his tea, and after that took it regularly, waking from sleep punctually for that purpose at twelve o'clock. Up to that time he had never been a tea-drinker, though he had occasionally tasted tea. Writing home to his mother he informed her that he had taken to the custom of drinking tea, but had acquired the habit of taking it at a very inconvenient hour, twelve o'clock at night. She replied, telling him he had come honestly by the liking, as his father and grandfather had had exactly the same habit. Previous to the reception of this letter he had never heard of the peculiarity of the father and grandfather.

But nowhere in the animate world is this principle developed to the degree that it is in the vegetable kingdom; so there seems to be no possible variation which can not be fixed by resorting to it. By careful selection of plants of any given type, and separating them from the influence of others, through successive generations, we can produce seeds that are certain to develop plants which are practically identical. We say practically identical, but it is only practically, for even in the best fixed strains there will always be plants which show some degree of variation; and these in turn only need be selected and isolated to establish strains showing each peculiar variation.

With this view of the constitution and genesis of varieties in the case of vegetables, it is easy to see that the permanence of any variety will largely depend upon the minuteness and accuracy with which the original ideal is defined, and the faithfulness with which that ideal is followed in the selection or breeding of the seed. But how vague and indefinite are the descriptions of even old and well-established varieties of vegetables! How insufficient and unreliable, as a guide to intelligent selection! How certain it is that with such an indefinite statement of the thing to be aimed at, growers will unconsciously set up different standards for the sort, and each select toward his own ideal. We shall thus have, growing up in almost every variety, strains differing more or less from each other, and each having pre-eminently the merit that somebody considers most valuable.

What more natural than that each of these strains should be named, and so we come to have any number of varieties springing from the same source and hardly different enough to be distinguishable? Thus, of First Early smooth, yellow peas, there were offered last year at least twenty different strains, such as First and Best, Rural New Yorker, Maud S., and Hancock, all alike in general character but each having some real or fancied element of superiority, one being the best in evenness of growth, another in evenness of ripening, a third in size of pod, etc.; and it does not seem to me that there is any unfairness in such division of a sort into different strains, or in a forceful presentation of the particular merits of each. The only unfairness is in the exaggeration of such merit as it may possess, and the claim that it has those which it does not. Nothing would do more to improve the condition of horticulture, as regards vegetables, than a more accurate and truthful description of the merits and faults of standard varieties, and nothing would add more to one's enjoyment of his garden and its products than more careful study of the peculiarities of the different kinds. No competent cook would think of cooking Rhode Island Greening and Spitzenburg apples in the same way, and yet the difference in character between the two is no greater than exists between varieties of

American Wonder and Yorkshire peas; but most people think that all peas are peas so far as cooking is concerned. Prize Head is one of the poorest of the lettuces to eat with oil or butter, but one of the best to cut up with vinegar and sugar. Some varieties of sweet corn are best if eaten when very young and tender, while others are best when quite matured.

The differences are little thought of and considered; and yet, they are what makes one variety popular in one family and section, while another, considered quite inferior by the first parties, is esteemed to be the best by others. As a seedsman I am continually asked, what is the best beet or cabbage. a question I can no more answer intelligently than a minister could tell what kind of woman would make the best wife. If by what I have said I have interested any one so that he will in the future make more careful study of the distinguishing merits of the varieties of vegetables, and consider just what use he is to make of what he raises—know better just what they want and then, by study of the description of the varieties offered, intelligently select that particular strain which best meets his requirements, I shall have done more to bring about an improvement in our American horticulture than I could in any other way.

Before adjournment the fruit on exhibition was presented to Mr. W. A. TAYLOR, for the department of agriculture, for use in making wax models for purposes described in his paper.

The meeting adjourned till 9:30 o'clock, A. M.

Thursday Morning Session.

The closing session was marked by as great interest as that manifested at either of the others, and by scarcely less attendance. It began with the reading of the following paper, by Mr. R. J. CORYELL of Jonesville upon

DEVELOPING A LOCAL MARKET.

Many of our towns and small cities are better markets for the horticulturist than the larger cities. Those places are overlooked by the growers, who are too apt to send everything to the nearest metropolis, paying transportation and commissions for the privilege of selling travel-stained goods in an overcrowded market.

It is a not infrequent occurrence for some overlooked market to send to these larger places for fruit and vegetables and receive products that had already gone once over the same road and now are sent back more or less near their place of growth, in a wilted or damaged condition, a detriment to every one but the railway and commission man.

It is in these places that the gardeners are finding new markets, or that persons living near find an opportunity to extend their farming into more profitable channels.

How to create and establish a trade and to increase it in such places is the object of my paper. The best method of reaching the consumer is to run a delivery wagon. The commission of the seller will more than pay for the extra work, and the sales are more easily increased and the custom-

ers more easily retained if there should be much competition at any time. I will give my reasons for these conclusions.

The producer and consumer, meeting daily, establish a friendly feeling that will generally continue as long as the customer is honestly dealt with. The latter's tastes can be more easily learned, and their supplies more readily be selected to their satisfaction. Mistakes on your part, such as selling damaged fruits or vegetables, can be more easily corrected, and with a better feeling than if the complaints went through one or more hands before coming to the grower. If a merchant handles the produce, the sales are limited to a certain extent to his customers; but if the grower undertakes to supply all the stores that may wish to handle such products, it will be impossible to do so impartially and to their entire satisfaction.

If you establish a successful business, some time or other there will be competition. The customers are the merchants' customers and not yours, and if some of those merchants should make arrangements to get their supplies of others, the consumer buys them just the same, and you, who have gone ahead and created the market, are robbed of the benefit. I combine the two; and if anyone wants an extra supply, it can be had at any time from the store.

In starting in the business, try to obtain some of the best people in the place. Tell them plainly your intentions and secure their consent for a trial before the fruits and vegetables are ready to sell. By doing this, the best consumers are secured from the first; and when the time for delivery comes, a route is already established and the dread of peddling is removed. Invite the customers to make criticism. The best customers may be hard to please, but I have found them willing to pay well for what they want, and supplying their wants will teach the grower to be particular and painstaking. These qualities should be early learned and always retained.

My specialties have been small fruits, with a few vegetables that come in the season of the fruits. The first that goes on the market are the strawberries. I use the Hallock boxes and the sixteen-quart crate. They are stamped with my name and are returned to me and are used over and over as long as they look presentable, but are all destroyed at the end of the season. Thus the cost of the packages is but slight, and the neat appearance is retained. I aim to never let any inferior fruit go to market. The sorting is done by the pickers in the patch, and they also face the boxes on top—not with the largest berries, for they are generally too large to let the next box above rest on the lower one without mashing them, but with the medium-size berries placed with the hulls down. The object is to get each box uniformly full and add attractiveness.

The tendency of pickers is to get a box about two thirds full and then put a big handful in the center and leave it for a bone of contention and trouble hereafter. Facing the box makes it a thing of beauty to the picker; and to make all of his work look nicely, each box must be faced just so. From being particular with the top, they are likely to be neat all through the box. Most of my pickers have grown up in my strawberry patch, and they require very little overseeing. Their pay averages about two cents per quart. By this way I secure uniformity and my customers always know what they are getting.

I have always established my own price, and by the time the season is fairly open I set my prices and stick to them. By doing this I can begin to take orders for canning at once, and my customers know that, no matter when they take the berries for this purpose, the price will be the same.

By this way, whenever the bulk of the berries ripen I am ready to dispose of them.

By the time our home-grown berries ripen, foreign berries, mainly from Bristol, Ind., are selling at ten cents per quart. I start at twelve cents and drop to ten when the main crop ripens, and hold to this point through the season. This has been the case for a number of years past, but this season was an exception. Berries were very plentiful and sold mostly at eight cents. The one thing to guard against in fixing the price is, not to charge one customer more than another. That is something they can not forget and will not forgive. When the people find out that they can not buy for less than the price, they will stop trying to haggle over it. My experience tells me that prices do not change as readily in a small place as in the city markets. The people do not take it kindly. If I can get ten cents for strawberries I do not raise after the crop begins to grow scarce. It is a fair price, and the customers are the only ones supplied at those times. So, if you stick to them at those times they will always look for you to supply their needs.

This year has been a bounteous season and a large acreage looked to my town for a market, one grower having several acres of strawberries. I kept a part of my plantation heavily mulched in the spring, to retard their blossoming, expecting to supply the late market. The late frost of about May 16 caught these vines at a critical time, and that portion of the crop was almost a failure, while the rest of this patch and one other escaped injury.

With us the raspberries follow strawberries without a break, and a steady supply is kept up. I raise both the black-caps and the red varieties, mostly the latter, as there is quite a plantation of the Ohio at our place, set out for the purpose of drying, but large quantities are sold in the fresh state. The Shaffer, a purple variety, is liked by many of my customers. I recommend it highly for home markets. With us blackberries have been a failure more often than a success, and I do not raise them. But as the grower has the market or a good list of customers looking to him for their supplies, he should make the market continue until the last of the winter's fruit is sold. Those varieties should be planted that give a succession, and leave no breaks in the succession, if it is possible to prevent it, following the berries and currants with grapes, plums, peaches, and apples.

In our market quite a demand for grapes was made by mixing the black, red, and white together in the same box.

It is possible, when the grower is in daily contact with the consumers, to experiment in many such ways to tickle the palates and please the fancies of the customers, by combining and arranging the various supplies in many such ways.

REPORT ON EXHIBITS.

The committee on exhibits made report as follows, which was adopted:

The committee find on the tables, collections of fruits as follows:

By Wm. B. Andruss of Allegan, thirteen varieties of apple, embracing Rubicon, Dyer, Danvers Sweet, and Cooper's Market, besides the standard winter varieties.

W. P. and Arthur Green of Eaton Rapids have eleven varieties of apple, two of pear, and Catawba grapes. Of the apples are to be noticed Roxbury Russets and Belmont; the pears are Angouleme and Clarigeau.

Allen Crawford of Eaton Rapids, has twelve varieties. Here are to be noted especially Grimes' Golden and Oakland; also Anjou and, probably, Mt. Vernon pear.

M. H. BAILEY of Dimondale, has five varieties, of which Westfield is the only one not found in the other collections.

S. M. PEARSALL of Grand Rapids has four varieties.

D. G. EDMISTON of Adrian, has Ben Davis apple and Glout Morceau, Dana-Hovey, Winter Nelis, Lawrence, Vicar, and Diel pears.

NELSON BOGUE of Batavia, N. Y., has one plate of Anjou pears. Of these especial notice is required. We think it safe to say they are the finest lot ever placed on exhibition at a meeting of this society. They show what can be done by a thorough understanding of one's business.

W. F. BIRD of Ann Arbor, has eleven varieties of grape, embracing Ulster, Duchess, Mills, and Amber Queen, besides the old reliables, Concord, Salem, Niagara, etc.

Prest. T. T. LYON of the South Haven experiment station, shows 15 varieties of grape, embracing Pocklington, Empire State, Jefferson, and Iona, as well as the well-known varieties.

W. A. TAYLOR of the department of agriculture, Washington, exhibits several pecan seedlings, Paragon chestnut, almonds, and seedling dates from California, also a Japan pear and seedless apple.

Last but not least, is to be noted the Japan persimmon presented by Chief SAMUELS, of the World's Fair. This has attracted especial attention from its beauty and rarity.

To attempt to describe the individuals would take too much space, but we would say all are in fine condition. We have specially named the varieties that would particularly attract attention in each collection.

In addition to the fruit, WM. STAHL of Quincy, Ill., has samples of spraying machines which have added much to the interest of the exhibit.

A. G. GULLEY,
C. A. SESSIONS,
H. B. DAVIS.

REPORT ON RESOLUTIONS.

The subjoined report of the committee on resolutions was adopted by a rising vote:

Your committee on resolutions recommended the following:

Resolved, That the State Horticultural society take this occasion to thank the Eaton County Horticultural society for inviting us to meet with them, and also to thank the society, and the citizens of Eaton Rapids and vicinity, for the generous manner in which we have been entertained. They have hospitably thrown open the doors of their homes to receive us gratuitously, and provided the conveniences of a commodious hotel with a bountiful table, at a nominal expense.

We appreciate the arduous labors of the president and secretary, night, morning and noon, these three long days, and the many able papers, especially by men from abroad.

We recognize the thoughtfulness of the committee of arrangements in providing the spice of life by introducing singing and recitations.

We heartily thank the singers and Miss MILLER and Mrs. OYER, for so thoroughly inspiring and thrilling us, and enlivening the occasion, which has added so much to the interest of the meetings.

We also thank the press, to-wit, the Eaton Rapids Journal, Farmers' Review of Chicago, Grand Rapids Democrat, Detroit Free Press, and Detroit Tribune for the enterprise they have shown in reporting our proceedings.

JAS. F. TAYLOR,
C. A. HAWLEY,
L. R. TAFT,
Committee.

COMMITTEE ON TRANSPORTATION APPOINTED.

The following resolution was introduced by Mr. C. A. HAWLEY and supported in remarks by Messrs. STEARNS and RICE, and was adopted:

WHEREAS, The success of the horticulturist depends largely upon quick and cheap transportation of fruit, and

WHEREAS, The consumers are debarred from the plentiful use of fruit, because of the length of time it takes to reach them, and the high rates of transportation, therefore,

Resolved, That a committee be appointed by the chair to act as a transportation committee, to confer with railway companies and all transportation companies as to carrying fruits from orchards in this state to all portions of the state as quickly and at as reasonable rates as possible.

The chair named Messrs. HAWLEY, STEARNS, MORRILL, and RICE, as the committee provided for by the above resolution.

REPORT ON THE FINANCES.

Chairman RICE of the finance committee presented the following report which was adopted:

The committee have compared the reports of the secretary and treasurer and find they agree in all respects. We have also examined all the orders, checks, vouchers etc., and find that all agree. We also find amounts of interest on mortgages and bonds agree with statement of reports. All of which is respectfully submitted.

L. B. RICE,
A. G. GULLEY,
S. R. FULLER.

REPORT ON PRESIDENT'S MESSAGE.

Concerning the recommendations of the president's message, the following report from the committee was adopted:

Your committee to whom was referred the president's message report as follows:

1. As to memberships. That our treasurer at any time and all times urge people to become members of the society. With those joining in localities having local societies, the payment of the fee shall constitute each a member of both the state and local society for one year: also, that by personal solicitation and corresponding he do all he can to increase the life memberships.

2. That we favor the suggestion relative to the upper peninsula, and the furnishing of surplus reports to granges, agricultural societies, or similar organization in counties where no horticultural societies exist; that the carrying out of these suggestions be left to the secretary rather than a special committee.

3. As to auxiliary societies, our relation to the department of agriculture at Washington, and the exhibits at the World's Columbian Exposition, at Chicago, in 1893 having already been considered by the society, the committee make no recommendations.

4. As to exhibits at the meetings of this society, your committee recommend the offering of such premiums as the executive committee may determine at any meeting; also that efforts be made to induce individuals to offer special premiums for these exhibits.

C. J. MONROE,
J. F. TAYLOR,
C. A. SESSIONS,
Committee.

MATTERS OF MARKETING.

Beginning discussion of Mr. CORYELL'S paper, Mr. R. M. KELLOGG of Ionia said: The great secret of developing a home market lies in getting every family in town to eat several quarts of fruit daily instead of one. It is utterly astonishing how much fruit people will eat in the course of the season if you manage them rightly. If they become tired of one variety, have another of different flavor, color, and appearance for them to try. Don't allow them to think they can go without it for a single meal, and

you will be surprised to see how quickly it will cease to be a luxury and become an absolute necessity. Teach them that a fruit diet means clearer heads, cooler blood, and better equipoise of brain and brawn, and will save in many cases its cost in doctor's bills. Bear in mind it is keeping people everlastingly eating that develops a home market. I wish to emphasize that part of Mr. CORYELL'S paper where he refers to clean packages. Make the fruit look as neat and attractive as possible. Personal appearance, too, goes a great way when you are calling on customers. The fruit should be delivered direct to the family and it must not be mussed by rough handling. I had a fruit wagon built with side springs nearly seven feet long. It rides as easy as a boat. No matter how fast I drive, my fruit is never "jumped" or bruised. The wagon is handsomely painted and lettered with gold and provided with a large gong-bell so I can let people who are not regular customers know I am in the neighborhood, and regular customers decide on what they want before I get to the door. I provide each regular customer with a properly printed card which they bring to the door and have their order charged and pay weekly. Women don't usually have change and would go without fruit if they had to pay down; besides, making change takes a great deal of valuable time. You will need to win the confidence of your customers. When you have done this you will find it a big stock in trade. Never sell anything to a customer that is not just what he thinks he is paying for. Keep posted on all matters pertaining to fruit, and be prepared to explain all the latest points in canning, and see that they are supplied with an abundance of each kind for that purpose. Exercise your skill as a salesman and you will soon hear more about getting fruit to supply the home market than of finding a market for what you grow.

Mr. BIRD: But often there is a surplus of fruit and one can not keep up his price. Indifferent growers flood the market with inferior fruit that depresses the price of all grades.

Mr. RICE: I know a man who sold largely of berries to dealers in town. It would often happen that such fruit would be abundant and of slow sale. So he put in a small dryer and practiced replacing with fresh fruit any of his own which became at all stale in the dealer's hands and drying the latter. That relieved the market and he made money on the dried fruit.

Mr. GARFIELD: I sell nothing at retail. For years I have sold exclusively to two firms and never taken money from any of their customers except through them. So, in times of glut, they help me out. Dirty packages are the bane of Grand Rapids. Hollanders buy the empty boxes and cases and refill them so long as they will hold together. I have tried to

get dealers to refuse to sell the empty packages, but have not been successful. I used to advocate and practice use of the full dry-measure quart, but have had to succumb. I was beaten entirely out of my trade and had to "cave." A man can't stand all alone on high moral plane in the Grand Rapids fruit trade. I used to put my name on my packages until a Hollander bought them second-hand and began selling trash under my name and guaranty.

President Lyon: I know a society that once resolved to use only full dry-measure quarts and pecks; but the package-maker who tried the experiment of supplying them with such found himself left with a great part of the packages on hand.

Mr. Kelly: I sold fifty bushels of black-caps to a dealer, by dry-measure, and found he repacked them all into wine measures.

The last paper of the programme was the following, by Mr. R. M. Kellogg of Ionia, a highly succeesful man in his specialty, upon

IMPROVEMENT OF SMALL FRUIT PLANTS BY SELECTION.

William Steele, whose farm adjoins mine, paid $6,600 for a two-year-old heifer which had never given milk, nor was there any absolute certainty that she would make a successful breeder. It was not a "blind" sale, for it occurred at the Chicago fat-stock show and there were present a large number of the best stockmen in the country, and the bidding was very spirited until Mr. Steele secured the prize at the price named.

It might be profitable for purposes of comparison, to study the history of this animal and learn the reason for attaching so much value to her. She was the ideal type of one of the most illustrious families of the Shorthorns. Her ancestors on both sides, for many generations, had been uniformly the greatest prizetakers at the largest stock shows in this country and Europe. There had not been a single break, and matings had been made with the greatest care that even the slightest defects might be eliminated from the offspring. Her registered pedigree on both sides went back into the last century, so that all probability of reversion or taking on the defects of remote ancestors had been removed. The offspring of these famous animals were valued away up in the thousands, having been sold as high as $42,50C, and at these fabulous figures were enormously profitable.

Their real sterling worth as breeders is not questioned. No successful stockbreeder thinks of touching an animal until he thoroughly investigates its pedigree, for it is conceded by all that the same care will produce with the best animals a much larger percentage of clear profit than with common scrub stock.

Now, plants are male and female, and are governed by all the laws that obtain in the breeding of animals. The organs of reproduction are as perfect in one as in the other, and are as much improved by selecting perfect specimens for mating. Plants are subject to disease and transmit their constitutional weakness with as much certainty as do animals, and manifest as great tendency to revert and take on defects of ancestors. Cross-fertilization and bud variation are the methods of producing new varieties.

All planters know that from the same seed the greatest variations of form, color, and productiveness are constantly developing.

Let us look for a moment at the treatment animals and plants receive at all our fairs. An animal to be famous as a breeder, must be a great prizetaker and must be passed upon by eminent judges and pronounced perfect in all points. The first premium always means superiority over all competitors for breeding or some special purpose. If a breeding animal is a universal prizetaker, and the offspring is known to be superior, his services command large sums and are sought for by the most skillful breeders. The premium is awarded to the individual and not to the class to which it belongs. Now, look at the prizewinners in horticulture. They go through the orchards, picking a specimen from this tree and that until the collection is made. The tree that is loaded year after year with the finest fruit, true to type, high in color, rich in flavor; its perfect foliage and smooth trunk indicating perfect health, and has stood the blast of the severest winter, is entirely ignored in your awards. The same holds true with a vine or plant standing among its commonplace fellows and yielding the most magnificent fruit, veritable sweepstakes at your meetings; but the vine or plant as individuals are entirely ignored. They die in oblivion. I do not believe there is a commercial nurseryman in America today who seeks out these trees and plants and makes a special feature of propagating from them.

We admit there are some seedsmen who have practiced selection until they really have become famous for their skill in improving known varieties. In the case of fruits, I believe it is a universal rule of nurserymen to take scions from nursery rows or any trees most convenient, of the variety desired. Downing points out clearly that a graft from a diseased or weak tree will transmit the disease or weakness to healthy stock, even if grafted a dozen times in succession. I believe this has more to do with the failure of orchards than any other cause. The truth is, the nursery business has degenerated into a mere speculation, the winning man being the one who can sell stock the cheapest. Year after year the strawberry-grower goes to his fruiting beds and digs up plants between the rows where they have stood unprotected, freezing, thawing, and heaving under water, or dried up by the winds of winter until their constitutional vigor is utterly destroyed. What is the result? Go into the field at harvest time: the first few feet of a row are loaded with fine fruit, the next has scarcely any, and then follows a vacancy where plants have not vitality enough left to grow, and so on throughout the whole field, the soil, fertility, and cultivation being all the same. Why is this? The mother plant from which the first came was strong and vigorous; in the second instance the vitality was lost, perhaps through the process of bud-variation or reversion, or quite likely the plants had been formerly taken from an old, exhausted bed, where seedlings had come up. I do not know of another grower whose plants are not more or less mixed with seedlings or spurious plants. No attention whatever is paid to selection.

The power of bud variation has become generally recognized. Many of our most valuable varieties are nothing but sports (bud variations). Thus the Golden Queen raspberry is a sport of the Cuthbert. During the past season, I found in the boxes, while marketing, several berries partly red and partly yellow, the red part being identical with the Cuthbert. I hope the coming season to find the canes on which these berries grow, that I may experiment with them. The Boston nectarine is conceded to be a

sport from the peach. The wonderful new grape being now introduced by our townsman, GEO. HOSFORD, he claims is a sport from Concord.

The clamor is heard from one end of the country to the other, for something that will equal the old Wilson strawberry of thirty years ago. When the Wilson has been kept pure by careful selection it has no equal among the perfect-flowering sorts of today. Nothing on my farm will approach it, and I have tried pretty much everything offered. Where the Wilson has failed, you will find, on careful investigation, that no effort has been made to preserve its purity. Dealers prefer it, and many of my best customers will have nothing else. I speak of it as a perfect-flowering variety. I admit the Crescent is more vigorous and more productive; but, like the Wilson, and for the same reason, it has been given a back seat by many growers. As a cash-bag filler these two varieties are yet the champions. They have made more money for the grower than all other varieties put together, where they have been kept pure by proper selection.

A pedigree plant may be said to be one which possesses the best points of its variety in the greatest perfection, with the ability to transmit these characteristics to its offspring. The want of fixedness of the desirable features in our new varieties is the main cause of failure when they pass out of the hands of their originators. Their changed conditions and different methods of cultivation render the bud variations so great that, for want of proper selection and exclusion of inferior plants, their value is lost. No one can estimate the loss to fruitgrowers from this cause. The truth is, we have gone wild over the introduction of new seedlings. They come upon us with such a flourish of printers' ink and lithographic art, that we are utterly bewildered. Our fruit lists are altogether too long. There is no earthly reason for continuing one quarter of the varieties we now have. We have not made the substantial improvements we should have made had we devoted more time to the accumulation of the good qualities of the old standard sorts by propagating from those that produce the prizetakers, ever bearing in mind that the value of pedigree in plants, as in animals, is in the long continuance of the most valuable characteristics, that the tendency to variation and reversion may be as nearly destroyed as possible. I do not mean to say that we should discontinue all efforts in the direction of producing new varieties; but the proper testing of them is altogether too expensive. It should be relegated to the government experiment stations and those who can afford to do it.

But to the practical part: How shall we make these selections? My method has been to study the variety until I had a true ideal of the type to work from. Study the berries in the boxes, on the vines, the foliage and its habits; fix these firmly in your mind, then go into the fruiting field to look for this ideal plant. Having found it, examine every leaf to see if its foliage is perfect, and free from all diseases and fungi. If the variety is deficient in foliage, its fruit too soft, or has not the desired form, select with a view to correcting these deficiencies. If a strawberry, as soon as the berry is sufficiently developed to reveal its true character, remove its fruit, that the plant may not be weakened, stimulate it gently with liquid manure, and pot all the runners and remove them to a bed especially prepared for the purpose. Next year use only plants from this propagating bed, and select again, year after year. Carefully mulch and give thorough culture. Never allow a plant to go to the field that shows the slightest deficiency. You will be suprised at the fruit, both in color and size, as well as in the prices you will command. In the case of those

varieties propagated by root cuttings, when you have found your ideal of fruit and bush, mark it and at the proper season take up the roots, carefully cutting in proper lengths; put them through a perfect callousing process, and plant in nursery rows; never use suckers. They are often sent up as the result of disease or injury. If the variety be propagated by tips, be specially careful that nothing goes into the ground save those that are perfect in all respects. Thus we are able to augment the good qualities by securing all variations in the desired directions and discard defects every year as they appear, until we have the highest perfection. I have succeeded by this method in making very marked changes in foliage and firmness as well as color and greatly increased productiveness. Much patience and long experience will be required, but the compensation in the end will be ample. By pursuing this course we shall to a very great degree solve the problem of disease. Weak and sickly plants are always the first to succumb to attacks of vermin and fungi. We are thus able to produce such a healthy growth that vermin are powerless to injure. If we add to this the burning over of strawberry beds every year, or plowing under after one picking, the pests which ruin so many plantations will disappear. Cultivate thoroughly, fertilize thoroughly, study the business thoroughly, and you will be thoroughly successful.

THOUGHTS THE PAPER CALLED FORTH.

Mr. L. B. RICE spoke severely against the practice of nurserymen who takes scions from nursery rows. He believed scions taken from the best of bearing trees are much more desirable, especially in the way of securing improvement of varieties.

Mr. W. F. BIRD referred to the importance of turning over new varieties to the experiment stations for testing and report. We should have a half dozen sub-stations in the state for this purpose.

Mr. RICE: Mr. WILLARD has well spoken of the Lombard plum as a fine grower; it is such, and I keep a row of Lombard trees for use in testing new plums by grafting.

Mr. J. F. TAYLOR: On our lake shore more thought and work and worry have been given to the peach than all other fruits combined, until lately. Those who propagate the trees have given special attention to selection of improved strains and varieties. The propagator goes back to original stocks of such for his buds, and the result is that varieties there are superior to the same kinds elsewhere. But old trees have so many blossom buds that we can get but few leaf buds for grafting without severe cutting of the trees. We could not, therefore, afford to bud all the young trees from old ones, and so in the second year we get buds from stocks from these originals, the nurserymen exchange buds and so keep up a uniformity.

Mr. KELLOGG: If I select heavy bearing sorts of strawberry, I avoid a great deal of work that would otherwise result from runners.

Mr. S. R. Fuller: When I began cultivating strawberries, I took Mr. Lyon's advice and pulled out every plant I found not bearing true to name and did the same with plants I found not blooming. I grow plants specially for planting, not taking them from bearing beds.

Mr. Pearsall: Stocks affect the growth of trees but not the fruit, is my experience.

Replying to a question as to value of "Odorless" phosphate, which agents have been offering with big promises, Mr. Rice said: Dr. Kedzie has said this phosphate is worth as manure $13 per ton, but $30 per ton are asked for it. I have used it among peach trees, and in contrast with Homestead phosphate on potatoes, I do not know that it caused no worms, no bugs, bigger tops, heavier potatoes, and more good ones, but such was the result. Mr. Pearsall cited a case where this fertilizer had apparently caused an increase of one third in a crop.

Mr. Kellogg (replying to question): Hen manure is good for small fruits, but care must be exercised in its use, for it is very strong. Compost it with three or four times its bulk of earth or reduce it by mixture with stable manure, leaves or other such matter. As to the best time to apply manures, I prefer the autumn, decidedly. If there is danger of washing, cultivate it in lightly: otherwise, let it soak in.

Mr. Gulley: Very good, but get it upon the ground any time when you have it.

Mr. W. F. Bird: Has any one had experience in selling the Ulster Prolific grape? I find it hardy and productive.

Prest. Lyon: It has not been in the market enough to have established a reputation. It is much superior to the average market grape. Its hardiness is not yet well tested, but it is prolific enough.

CELERY CULTURE AT KALAMAZOO.

Mr. Jonathan Wilson of Kalamazoo had sent to the secretary the following paper, which was at this time presented:

The way that celery-raising is going on now, the outlook is very discouraging. In the first place, we have hot, dry weather, which causes the leaves to parch and dry up, that stunts the celery so that it has to commence growing again from the center. Thus, you see, it loses valuable time. If the outside stems and leaves could be kept good, see what a difference for good for our Kalamazao celery. Kalamazoo is losing her reputation every season, and she must do something soon or other places will go ahead of her and she will lose her place in the market. Another thing I want to speak about is that miserable little insect. He is looking out for number one all the time, and he tries to do it in as comfortable a manner as possible. In hot, dry weather he seeks the inside of the plant, in order to be in the shade, and all the time he is there he is busy pecking away at the heart, thus stunting the plant again. If we could keep him out we would

gain much valuable time, for all that he eats has to be made up again from the center. So we are losers from two causes, the weather and insects.

Now, how are we going to overcome these difficulties? One way is to order up just such weather as we want. That would overcome the parching of the leaves, and leave us able to keep all that we have. The other remedy is to keep the insect out. If these two points could be gained how much it would be in our favor; and we must do this, as near as we can, or we are lost, and Kalamazoo's good name in the market is gone and her place is occupied by some one else less worthy; for what we have gained we have worked hard, and we must keep it if we can. You may say in your minds, what does all this talk amount to? and what would it amount to if Kalamazoo should lose her standing? I will tell you what it amounts to. It amounts to the loss of a million dollars to us, which is quite an item toward running the inside of such a town as ours. Some one asked me if it took much intelligence to raise celery. I thought it did, and I will say right here that it will take more intelligence for the next ten years to raise celery than it has in the past ten years. You ask why. Every farmer knows that when he raises one crop in succession on a certain piece of land, year after year, the land grows tired and needs rest or change of crops. So it is with our celery lands. They begin to need rest or change of crops. My experience has been that larger celery can be raised on new land, if we give it the same amount of manure that we do the old land.

That being the case, I think that we can renew our marshes by going a little deeper every year and bringing to the surface some of the unused soil below; for, if any of you have noticed on our marshes about Kalamazoo, the celery roots never try to enter the brown subsoil six or eight inches below the surface. So I contend that if two or three inches of this brown subsoil were brought to the surface every year, it would help the soil in two ways. First it would give a new coat of earth on top, and by going deeper every year we get more depth of soil that the celery roots will go down for instead of spreading over so much surface. Celery is a very hungry feeder. After the plant is set out, it is like a great many human beings who have just started out in life. It commences to look around to see what is best for itself, not going down but spreading over a great deal of surface. I have seen the roots reach out three feet each way from the plant. So if we could get those roots to go down they would have more moisture to sustain the plant. Some one may ask, when do you bring this brown subsoil to the top? I answer, that the fall is the only time that it should be brought up. Then the frosts have a chance to work on this cold, wet subsoil and convert it into plant food. According to this theory, it takes one year before this soil is ready for use. I think it would do some of us good if we would look away to some of the old countries which have been raising crops on the same soil a number of thousands of years, and still the soil holds its own and raises just as good crops as when it was first used. Take Japan, for instance. I dare say she is raising just as good crops today as she did a thousand years ago; or, China is raising just as good crops as she did when she first began cultivation of the soil. I think some are trying to raise too much in one season off from one piece of land. The growers start out as early in May as they can, place their rows two and one half feet apart, putting the plants about four inches in the row. If they succeed in getting this crop off by July, they will start another crop about four feet apart in the rows. By this method they are drawing very

heavily from the soil. Instead of raising the last mentioned crop, I would put the heavy plow in and bring up some of the brown subsoil, say two or three inches. If this were done the land would get a rest of about ten months. It would not cost much to try this method a few years; for if we could get a good heavy crop three feet apart, this plan would be much better. We could get more for the crop, which is just exactly what we are after; for if we could get as much money from one crop, by making it grow larger, as we could from the two, I think we would make quite a change. It would not only give the land a rest, but would give the man working the land a chance to rest also.

A PLEASANT CONCLUSION.

After brief closing remarks by the president and secretary, the meeting finally adjourned. The attendants repaired to Grand Army hall where the local society had spread a rich banquet. This was heartily enjoyed, and then, under lead of Mr. GARFIELD as toastmaster, responses were made to the following sentiments: "Eaton county at the front in horticulture," W. P. GREEN; "Horticultural values that can scarcely be measured," L. B. RICE; "Titles in fruits," Prest. LYON; "Applesauce," EDWY C. REID; "Beauty in horticulture," Rev. L. DELAMATER; "Michigan Agricultural College," C. J. MONROE; "Our duty to the wayside," S. M. PEARSALL; "The money value of horticultural water," J. F. TAYLOR; "Michigan's place in American horticulture," R. M. KELLOGG; "Horticulture, the handmaid of agriculture," A. W. SLAYTON.

THREE VALUABLE PAPERS.

The Mutual Influence of the Stock and Graft,

By A. A. CROZIER, of Ann Arbor, Mich.

Diseases of Trees Likely to Follow Mechanical Injuries,

By WM. G. FARLOW, M. D.,

Professor of Cryptogamic Botany, in Harvard University, Cambridge.

Communicability of Peach Yellows and Peach Rosette,

By ERWIN F. SMITH, SC. D.,

Special Agent of the U. S. Department of Agriculture.

THE MUTUAL INFLUENCE OF THE STOCK AND GRAFT.

BY A. A. CROZIER.

The question of the influence of the stock upon the graft, and *vice versa*, is one of those subjects in plant physiology which has never been systematically studied by the botanist or horticulturist, and upon which widely differing opinions are held. The German botanist, GÄRTNER has collected the largest amount of evidence on the subject; several French botanists have experimented and written upon it, and a prize for the best memoir upon the subject has been offered by a Belgian horticultural society. English gardeners have recorded numerous observations in the English horticultural press. In our own country it may be mentioned that Dr. E. L. STURTEVANT and others have brought together considerable information in the Transactions of the Massachusetts Horticultural Society, Prof. L. H. BAILEY has presented a brief analysis in *Garden and Forest*, and an essay upon the subject has appeared in a recent bulletin of the U. S. Department of Agriculture.

In the following pages I have brought together most of the published material on this subject in such a way as to show the various opinions which have been held, and the evidence on which they are founded. Writers upon grafting have usually treated separately the influence of the stock upon the graft and the reflex influence of the graft upon the stock. I have found it more convenient to take up and discuss each kind of modification by itself, whether appearing in the stock, in the graft, or in both.

OPINIONS ON THE SUBJECT.

Erasmus Darwin recorded, in A. D. 1800, a number of cases of apparent influence of the stock and scion upon each other, but said: [1] "It is not yet certainly known whether the ingrafted scion gives or takes any property to or from the tree which receives it, except that it acquires nourishment from it."

THOMAS ANDREW KNIGHT, who probably made more experiments and observations in grafting than any other man has made, recorded a few instances where the stock affected the character of the fruit, but believed that such modifications were generally due merely to an obstruction of the sap as the result of the grafting, the resulting changes in the fruit being

[1] Phytologia, p. 386.

similar to those produced by the removal of a ring of bark or the application of a ligature.[1]

JOHN LINDLEY said:[2] "It seems allowable to infer that the goodness of cultivated fruits is deteriorated by their being uniformly worked on stocks whose fruit is worthless."

MCINTOSH, in his "Book of the Garden,"[3] after giving the testimony of various authorities upon the subject, says: "The influence of the graft upon the stock appears scarcely to extend beyond the power of communicating disease."

M. T. MASTERS, editor of the *Gardeners' Chronicle*, thinks[4] that English gardeners generally believe that the size, flavor, fruitfulness, and period of ripening of fruit may be changed by grafting, but not the form.

PATRICK BARRY said ("Fruit Culturist" 1851, p. 82): "A great many improvements may be effected, not only in the form and growth of trees, but in the quality of the fruit, by double working. Very few experiments have yet been made on the subject in this country, except from necessity; but the general interest now felt on all matters pertaining to fruit-tree culture can not fail to direct attention to this and similar matters that have heretofore in a great measure been overlooked."

A. J. DOWNING said:[5] "But whilst grafting never effects any alteration in the identity of the variety or species of fruit, still it is not to be denied that the stock does exert certain influences over the habits of the graft. The most important of these are dwarfing, inducing fruitfulness, and adapting the graft to the soil or climate."

J. J. THOMAS said:[6] "Grafting enables us to multiply an individual variety without a shade of variation to an unlimited extent." By this, however, he evidently does not mean that no change in the character of the plant occurs, for in the same connection he states that varieties may be brought earlier into bearing and rendered more hardy by being grafted on certain stocks.

PETER HENDERSON[7] believed that the stock had no effect on the identity of the graft. In roses he stated that each kind would retain its own color, form, and odor, upon whatever stock it was grafted. The stock he said had no effect upon the flavor of the fruit in apples.

WM. C. LODGE said:[8] "On the principle that the vigorous growth of the tree is at the expense of its fruitfulness, and on the other hand that prolificacy interferes with a vigorous growth, we understand that to work a strong-growing scion upon a weakly stock will bring the tree into fruiting at an early age. But why the stocks should hasten or retard the period of ripening, or how it changes the color, flavor, or size of the fruit, is not so easily shown."

C. M. HOVEY believed that grafting produced no other change than ordinary dwarfing, except when variegated leaved plants were grafted on green leaved ones.[9]

Prof. T. J. BURRILL says (Missouri Hort. Rep., 1887, p. 460): "All cases cited in the literature of the subject are due to simple nutrition or

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[1] Horticultural Papers, p. 221.
[2] Quoted, U. S. Dept. Ag., 1867, p. 315.
[3] Vol. II, 1855, p. 326.
[4] Gardeners' Chronicle, 1872, p. 322
[5] Fruits and Fruit Trees of America, 1869, p. 28.
[6] Rep. U. S. Pat. Office (Ag.,) 1856, p. 315.
[7] Country Gentleman, 1884, p. 1050.
[8] Report of the U. S. Patent Office (Agriculture). 1865, p. 281.
[9] The Garden, Vol. XVII, 1880, p. 493.

uncongeniality of union." Two exceptions he notes are the transfer between stock and scion of the disease known as variegation, and the influence of the scion on the form of the roots—the latter probably due to rooting from the stock. The question he says is not yet settled, adding: "If there is any effect upon the essential characteristics of the graft or scion it must come from the commingling of the protoplasm of the two [stock and graft] and this is exceedingly improbable at a distance from the graft."

THOMAS MEEHAN says (Mo. Hort. Rep., 1883, p. 266): 'Can the character of a tree be so changed by grafting as to produce such marked variations as could not follow from mere laws of nutrition alone? There have been some few observations made which seem to indicate the possibility of some such influence, but we must say that these have been so few that no general law that such is the case can be fairly drawn."

O. B. HADWIN of Massachusetts said: [1] "We have very little positive information as to the influence of the stock on the graft, but if such an influence existed to any considerable extent we should in time lose the original type of our fruits."

A. C. HAMMOND of Illinois said: [2] "It is now generally conceded by intelligent writers and cultivators, that the stock affects the fruit of the scion in quality, productiveness, and time of bearing. And that the scion increases or retards the growth of the stock, and in some instances imparts its own peculiarities to the root."

B. HATHAWAY of Michigan said: [3] "I am well aware that there is no other question connected with orcharding that will so arouse the feelings of prejudice, of personal interest, and denunciation among propagators, as a discussion of the relative value of the different methods of propagating trees. This of itself is sufficient evidence that this whole subject is not well understood."

The editor of the *Country Gentleman* says: [4] "After grafting many thousands of different sorts [of pear] on various stocks, and seeing many thousands of pears bear in orchards, we never saw as much change produced by the stock as was effected by soil and cultivation."

The editor of the *American Agriculturist* says: [5] "It has been accepted as a law by horticulturists, that the graft produces no effects upon the stock into which it is inserted other than, it may be, to communicate disease. A number of cases have been from time to time observed which would go to show that there are exceptions to this rule."

The editor of *Vick's Magazine* said: [6] "It is a question that has often been discussed, and there are some facts showing the stock in some cases to have a perceptible influence on the produce of the graft, but we know of no reliable experiments that have ever been conducted to throw light on the subject. One thing is certain, the difference between the stock and the graft must be very wide to produce any appreciable effect."

CHANGE IN HABIT.

The dwarfing of plants by grafting on certain stocks is so well known

[1] Transactions Mass. Hort. Soc., 1879, p. 19.
[2] Transactions Illinois Horticultural Society, 1870, p. 314.
[3] Report Michigan Board of Agriculture, 1871, p. 123.
[4] Country Gentleman, 1881, p. 678.
[5] American Agriculturist, 1868, p. 260.
[6] Vick's Magazine, Vol. II, pp. 241, 242.

that illustrations are hardly needed. There is some misapprehension, however, as to the meaning of the term dwarf.

A. S. FULLER says (*Horticulturist*, Vol. XXIII, 1868, p. 74.): "The common method of producing dwarf trees is one of the most familiar instances of the influence of the stock on the graft. But there is, however, a too general inclination on the part of the public to misapply the term dwarf, as many suppose that it is nearly if not quite synonymous with debility or stunted growth. This idea is an erroneous conclusion, for in many instances what are called dwarf trees are equal to and often more vigorous than standards. For instance, we will select two seedling stocks, one shall be the Mahaleb cherry and the other the Mazzard; both shall be of the same size and of equal vigor. Upon these we will insert buds of the May Duke cherry, or any other variety. Now, the chances are in favor of the bud on the Mahaleb stock making the most rapid growth for the first one or two years, and still the Mahaleb is considered to be one of the best stocks on which to dwarf the cherry. Now, the Mahaleb stock does not lessen the vigor of the tree, but merely imparts to the graft its peculiar habit of growing and spreading, and we are obliged to allow and assist the tree to grow in this form, or it will surely become feeble and perish. The bud inserted upon the Mazzard stock will shoot up into a tree assuming its natural form, but the influence of the stock will be to make it grow pyramidal and quite tall, because that is the natural habit of the Mazzard cherry."

All pears are dwarfed when grown upon the quince,[1] though they are likely to be more vigorous the first year[2] than when on their own roots.

A. S. FULLER says: "I have as a general thing secured a larger growth of the pear for the first two or three years, and even longer with proper care, on the quince than upon pear stock. The influence of these stocks is shown by imparting their peculiar form of growth to the graft, early fruiting, etc., more than in checking their vigor."

The dwarfing of plants by any means generally brings them into bearing at an earlier age and causes them to bear relatively more fruit and flowers. Thus, roses are said to produce larger and more numerous flowers on certain stocks than on others.[3] The crimson-fruited *Pyracantha Japonica* is far more fruitful and ornamental on the quince or hawthorn than on its own roots.[4] Burbidge states[5] that the Chinese Kumquat orange, *Citrus Japonica*, absolutely refuses to bear well on its own roots, even in its native hills, but that it produces heavy crops of its delicious egg-shape fruits when worked on the hardy *Limonia trifoliata*. Mr. Robert Fortune, the eminent Chinese traveler, informs him that this stock is universally adopted for this fruit by the native gardeners in China and Japan.

In the *Gardeners' Chronicle*[6] is recorded the following experiment of Mr. BARRON of Chiswick: The Blenheim Orange apple was grafted on French Paradise, Doucin, Crab, and English Paradise stocks. "At the present time the results of the experiment are very clearly apparent, the young trees on the French Paradise and Doucin stocks being full of bloom, while there is none on those worked on the Crab, and but very little

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[1] McIntosh, Book of the Garden, Vol. II, p. 327.
[2] J. G. Jack, Garden and Forest, 1890, p. 54.
[3] Trans. Mass. Hort. Soc., 1879, p. 23; The Garden, Vol. XXV, 1884, p. 62.
[4] Burbidge, Propagation of Plants, p. 60.
[5] Propagation of Plants, p. 60.
[6] 1879, p 296.

on those grafted on the English Paradise." The same difference was observed the preceding year, though whether or not that was the first year of flowering is not stated—and there is no statement as to following years. Mr. STOLE, the Director of the Pomological Institute of Proskau, writing in the *Monatsschrift fur Pomologie* for March, 1876, on this subject, recommends grafting pears on apple stocks. The main advantage of this stock is early productiveness. He states, however, that such trees are not long-lived.[1]

A. S. FULLER says (*Horticulturist*, Vol. XXIII, 1868, p. 75): "Early or late maturity or productiveness being characteristic of different varieties, the stock will therefore hasten or delay fruiting."

PATRICK BARRY says ("Fruit Garden," p. 19): "An apple tree on a common stock planted out in ordinary orchard soil does not usually bear until it is in most cases seven years old from the bud, often more; whilst the same variety grafted or budded on a Paradise apple stock will produce in two or three years at most."

N. A. BEECHER of Michigan says (Report Mich. Board Ag., 1889, p. 452): "Apples that are feeble in growth and tender should be grafted on some hardy, vigorous stock, like the Lyscom, Northern Spy, or Talman Sweet, when two or three years old. It is difficult to ascertain whether the graft has more influence on the stock or the stock on the graft. In most cases the stock seems to have the controlling influence, in others it is exactly the reverse. Some twenty years ago I set out fifty seedlings, three years old; two years later they were top-grafted to Red Canada; twelve of them died and were replaced with Northern Spy. In the same plat of ground I whip-grafted three Lyscoms, two years old, at the time that I grafted on the seedlings, and today they are much larger and stronger than those grafted on the seedling stock, and are exceedingly uniform in size and shape, while those on seedling stock vary in size, shape, and vigor, some being quite strong and others dwarfish; a few, in time, died outright, and the remainder range from fair to good. The best of those top-grafted on seedling stock measure now two feet nine inches in circumference, while the three Lyscoms, top-grafted to Canada Red, measure respectively three feet seven and one half inches, three feet six inches, and three feet six inches in circumference. The reason why I prefer Lyscom as a stock to the Northern Spy or Talman Sweet, is that it is just as hardy and is a much stronger grower in root and branch. In fact, it will produce more root in a given space of time than any other variety I ever propagated. It is just as necessary to improve the hardiness of tender varieties by top-grafting as it is to improve feeble growers by the same means."

Mr. B. HATHAWAY[2] of Michigan, gives several examples in which apples came earlier into bearing as stock-grafts and buds than as root-grafts. In the cases where a difference in the size of the trees was noted, the root-grafted trees were the larger. After the trees had attained a proper age, however, he had seen no difference in productiveness that could be attributed to the difference in the method of propagation. It is well known by nurserymen that a scion taken from a young tree which has never fruited will be hastened in its growth when grafted on a mature tree and bear sooner than it would if it had been left to itself. Still it is generally

[1] Quoted in The Garden, Vol. IX, 1876, p. 351.
[2] Report of the Michigan State Board of Agriculture, 1871, pp. 124-6.

taken for granted that scions from nursery stock or other non-bearing trees, or water-sprouts from bearing trees, will not come into bearing quite so soon as scions of moderate vigor taken from bearing trees. M. Carrière "declares that in budding roses he can produce plants that flower profusely, sparingly, or not at all, by selecting buds from different parts of the same plant." (*Popular Gardening* Oct., 1890, p. 14).

Increased fruitfulness as the result of grafting is in some cases due to added vigor. Thus the quince, when grafted on the thorn, is said to be longer lived and more fruitful than usual. This is probably the case in certain soils only. The *Vitis vinifera* is said in Europe to be more fruitful as well as earlier when grafted on the American *Vitis riparia* (*Revue Horticole*, 1882, p. 113).

BURBIDGE states[1] that Snow's Muscat Hamburgh grape in most cases bears irregular clusters, disfigured by a large proportion of small or undersize berries when grown on its own roots, but that it sets more perfectly on Black Hamburgh stock, a variety notable as being of robust constitution and a good setter. This change may be partially due to better fertilization.

DARWIN says: [2] "Thouin found that those species of Robina which seeded freely on their own roots, and which could be grafted with no great difficulty on another species, when thus grafted were rendered barren. On the other hand, certain species of Sorbus, when grafted on other species, yielded twice as much fruit as when on their own roots."

W. A. WOOLER states [3] that he grafted Paul's Scarlet thorn on the pear, and that the fruit produced, instead of being single-seeded as usual, contained from two to four seeds. A writer in *Gardener's Monthly* says:[4] "More than twenty years ago I procured grafts from an adjoining county of a large and almost *seedless* variety [of persimmon] and grafted them on a non-bearer. The result has been large, fine fruit, but very seedy."

THOMAS MEEHAN, the editor, thought it probable in this case that more perfect nutrition of the graft on the new stock caused it to produce better developed pistils, and therefore more seed.

THOMAS ANDREW KNIGHT [5] states that an apple grafted on the pear bore fruit, but that the core was black and the seeds wanting. No fruit was produced on adjoining trees of the same variety of the apple, frost having killed the blossoms. The frost, therefore, while it prevented the formation of the fruit on the original stock, seems only to have prevented the formation of the *seed* when grafted on the pear.

Other cases of increased vigor as the result of grafting may be mentioned. Thus, C. M. HOVEY states[6] that *Magnolia acuminata*, when used as a stock, imparts great vigor to such species as *glauca*, *Soulangena*, *Thompsoniana* and *Lennei*.

J. C. LOUDON says[7]: "*Acer eriocarpum*, when grafted on the common sycamore, attains in Europe double the height which it does when raised from seed. * * * The common lilac attains a larger size when grafted on the ash." MICHAUX states[8] that the striped maple (*Acer*

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[1] Propagation of Plants, p. 60.
[2] Origin of Species, p. 231.
[3] Gardeners' Chronicle, 1870, p. 458.
[4] Vol. XVIII, 1876, p. 113.
[5] Horticultural Papers, 1849, p. 222.
[6] Transactions Massachusetts Horticultural society, 1880, p. 115.
[7] Horticulturist, 1849, p. 283.
[8] J. G. Jack, in Garden and Forest, 1890, p. 54.

Pennsylvanicum) when grafted on stock of the sycamore maple (*Acer pseudo-platanus*) increased to four times its natural size.

J. SISLEY says:[1] "Tea roses, and particularly the more delicate varieties, acquire more vigor when grafted on the seedling briar than on their own roots."

These instances of greater vigor in grafted plants can in most cases be attributed to the vigorous stocks used. DARWIN, however, is inclined to believe that the mere fact of grafting on any different stock tends to give increased vigor. After discussing the vigor gained by changing seed, he says:[2] "Something of this kind apparently occurs in grafting and budding fruit trees; for, according to Mr. ABBEY, grafts or buds generally take on a distinct variety, or even species; or, on a stock previously grafted, with greater facility than on stocks raised from seeds of the variety which is to be grafted; and he believes this can not be altogether explained by the stocks in question being better adapted to the soil and climate of the place. It should, however, be added that varieties grafted or budded on very distinct kinds, though they may take more readily, and grow at first more vigorously than when grafted on closely allied stocks, afterward often become unhealthy."

Not only may a vigorous stock give increased vigor to the graft, but, conversely, a vigorous graft may cause the stock to grow more than it would if it had not been grafted. Thus, M. T. MASTERS[3] says that a quince stock, on which a strong-growing pear has been grafted, may be made to produce within a given time a larger amount of wood than any ungrafted quince would do in the same time. E. H. HART of Florida states:[4] "Wherever I have worked stocks of the sour orange with the lemon, which latter is of more rapid growth, the stocks increased in thickness very much faster than when grafted with the sweet orange."

PETER GRIEVE of England, relates[5] a remarkable example of the influence of the scion upon the stock: "An old Ribston Pippin apple tree, a much esteemed variety, is known to succeed indifferently on some kinds of soil and in some situations. The tree in question occupied what may have been considered a favorable position, viz., the west end of a south wall in an old garden. The original soil was not of good quality, being light and gravelly, and the tree, though annually producing some good fruit, was at the same time in an unhealthy and cankered condition. It covered, however, a large portion of the wall, and, being trained horizontally, each alternate rod or branch was removed to within a few inches of the stem, and these were grafted with scions of a strong-growing culinary apple, named Alexander, which grew rapidly; and the intention was to have, in the course of a few years, removed the remaining branches of the Ribston and regrafted them also with the sort just named. This intention, however, was very willingly abandoned, as the portion left of the Ribston improved so greatly in condition that it was gladly retained. * * * In the case of the grapevine some of the finest and best finished bunches I have seen of the Muscat Hamburgh and Mrs. PINCE'S Black Muscat were produced upon rods which grew upon a stock that also supported rods of the Trebbiano and the Alicante varieties. It is thus evident that the feeding power of the roots of plants is regulated by the

[1] The Garden, Vol. XXV, 1884, p. 62.
[2] Animals and Plants Under Domestication, Vol. II, p. 180.
[3] Gardeners' Chronicle, 1872, p. 322.
[4] Transactions Massachusetts Horticultural society, 1880, p. 175.
[5] The Garden, Vol. XXI, 1882, p. 364.

foliage or leaf growth. But in order that plants may derive the full benefit of increased feeding power, it is necessary that the soil in which they are growing should be judiciously enriched."

L. S. MOTE states[1] that vigorous grafts will impart their vigor to the stocks in the apple, pear, plum, and peach. J. C. LOUDON states that the mountain ash is said to grow more quickly on the thorn than on its own root, though the latter is the smaller plant.

The form of a plant may also be changed by grafting. This, however, is often due to increased or diminished vigor. Prof. BAILEY[2] quotes the familiar fact that the Red Canada apple is usually top-worked on some other variety to overcome its weak, straggling habit. The Winter Nelis pear is another example. J. G. JACK[3] states that *Larex occidentalis* grafted on *L. leptolepis* is less straggling in habit than when on its own roots. The trees referred to are from five to seven feet high, five of them seedlings and two of them grafts, in the Arnold Arboretum at Cambridge. *Cratægus digyna* is said to lose its thorns when grafted on *C. oxycantha.* (*Gardener's Monthly*, 1860, p. 30, from *Revue Horticole.*)

KNIGHT[4] says: "The form and habit which a peach tree of any given variety is disposed to assume, I find to be very much influenced by the kind of stock upon which it has been budded; if upon a plum or apricot stock, its stem will increase in size considerably, as its base approaches the stock, and it will be much disposed to emit many lateral shoots, as always occurs in trees whose stems taper considerably upward."

J. C. LOUDON[5] says: "*Cerasus Canadensis* [*Prunus Americana*], which in a state of nature is a rambling shrub [?] assumes the habit of an upright shrub when grafted on the common plum." R. P. SPEER says (Iowa Hort. Rep., 1888, p. 440): "There is nothing so easily affected by the stock as the plum. Mr. WELLING went into the woods and got forest plums and set them out, grafting them with Welling scions. Scarcely one of them was like the original tree."

M. PEPIN[6] says: Buds of *Bignonia grandiflora*, some of which were taken from a natural plant, others from a specimen of *Bignonia radicans*, were grafted on a plant of the latter species. The first graft was a *trailer*, its wood *brown*. The second graft became a *shrub*, its wood *green*.

M. CARRIERE[7] is said to have twice inserted grafts of *Aria vestita* on thorn trees growing in pots, and the grafts as they grew produced shoots with bark, buds, leaves, petioles, petals, and flowerstalks all widely differing from those of the Aria. The grafted shoots were also much hardier and flowered earlier.

Various other changes of habit have been recorded as having taken place as the result of grafting, some of which are remarkable. SAHUT states (*Revue Horticole*, 1885, p. 399) that woody species grafted on herbaceous ones prolong the duration of the latter. CARRIERE[8] states that he grafted the tomato on the bitter-sweet (*Solanum dulcamara*) and produced fruits upon the graft which in appearance were unchanged tomatoes, but the flesh of which was more dense, sweeter, and contained

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1 An article from the Botanical Index, in the Revue Horticole, 1881, p. 67.
2 Garden and Forest, 1890, p. 101.
3 Garden and Forest, 1890, p. 54.
4 Horticultural Papers, p. 223.
5 Horticulturist, 1849, p. 283.
6 Quoted in the Journal of the London Hort. Soc., 1851, p. 98 (Sturtevant, Transactions Mass. Hort. Soc., 1880, p. 99).
7 Revue Horticole, 1866, p. 457.
8 Revue Horticole, 1878, p. 80; 1882, p. 265 (Figure).

much fewer seeds than usual. He also grafted the artichoke upon the common sunflower and produced upon the stem of the latter, above the graft but near the ground, tuberous swellings like those of the dahlia. Mr. MAULE,[1] an English gardener, states that he grafted the potato upon the bitter-sweet and produced tubers on the roots of the latter. Professor BEAL of Michigan records[2] that some one set a potato scion in a tomato plant and induced the latter to form small tubers in the axils of its leaves. Director SPEER of the Iowa experiment station, says that a feeble graft often induces in the roots of the stock a tendency to throw up suckers, and that this tendency may be checked by regrafting the stock with a vigorous variety. Professor KIRTLAND of Ohio says[3] that "a graft of the Green Newton Pippin will invariably render the bark of the stock rough and black (the habit of the variety) within three years after its insertion." The Leon le Clerc pear is given as another example of a variety which has been observed to modify the character of the bark of the stock.[4]

No effect of the scion on the stock is more remarkable than the often noticed influence on the character of the roots. A writer from Plymouth, Michigan, says:[5] "In the nursery where we take pieces of seedling apple roots, and graft scions of different varieties of apple on them, the roots in one year partake of the characteristics of the variety grafted in. A variety having a straight, upright top sends down a few correspondingly straight roots. A variety with a thick, spreading top makes numerous spreading roots. * * * Where buds are put into two-year-old seedling apple trees, the seedlings being variable, it requires several years to change the roots, to make the nursery trees of a variety similar, and the time required to change with a weak-growing graft is greater than with a strong-grower, the trunk and roots still performing their office for the original variety."

"The graft," says C. A. GREEN of Rochester, N. Y., in the *New York Tribune*,[6] "has a remarkable effect on the roots of the stock. In starting apple trees in the nursery we graft on roots of seedlings, all of which, if unaffected by the graft, would exhibit no especial character; but when we dig these roots, after being affected by the graft for three or four years, we find that those grafted with Red Astrachan, for instance, are very fibrous, branching out near the surface with few tap roots, while the rows adjoining, or parts of the same row, grafted with the Duchess of Oldenburg, or the Fameuse, are destitute of fibers, possess only three coarse prongs, as a rule, one of which is liable to be a tap root, seeking an abode far down in the subsoil. It takes my men twice as long to dig a row of Fameuse or Duchess as a row of Red Astrachan, and when planted the roots of all were of the same character." J. B. MOORE of Massachusetts, says:[7] "Every nurseryman knows that the character of roots is changed, and that the roots of a row of Baldwin apple trees in the nursery will be alike, and the roots of a row of Roxbury Russets will be alike, and will differ from those of the Baldwins." O. B. HADWIN adds, in the same connection, that "if part of the same lot of pear stocks are grafted with Bartletts and a part with Onondaga, the two varieties can be distinguished by

[1] Gardeners' Chronicle, 1876, pp. 532, 538.
[2] Report Mich. State Board of Agriculture, 1876, p. 204.
[3] Horticulturist, Vol. II, p. 544.
[4] Josiah Hoops, Proc. Am. Pom. Soc., 1873, p. 130.
[5] Country Gentlemen, 1882, p. 312.
[6] Quoted in Rural New Yorker, 1880, p. 506.
[7] Transactions Massachusetts Harticultural society, 1880, p. 109.

the roots." BENJAMIN HATHAWAY of Michigan says:[1] "Not only are root-grafts of this [Northern Spy] certain to root from the graft, but when budded or grafted on seedlings it will develop in them a tendency to form a great many fibrous roots." J. W. TALBOT of Massachusetts, said:[2] "If the Siberian Crab is grafted on any number of stocks the roots will all run down." E. G. PARTRIDGE of Wisconsin, says in speaking of grafting apples on the wild crab (Transactions Wisconsin Horticultural Society, 1881-2, p. 38): "If we start with the crab root we shall in time have the top standing on its own roots, the old roots gradually dying out, or on roots from which the original properties and characteristics have been eliminated." A writer in the *Horticulturist* says:[3] "Upon removing the plants from a bed of seedling Canada plums (the wild red plum of our woods), about a hundred of which were budded last summer with the Imperial Gage, Red Gage, end Jefferson plums, and which had made a growth of four or five feet the present season, and were quite stocky, I found that the amount of roots of the budded trees was less that half of those remaining unbudded, and the color was a shade deeper. The Canada plum is remarkable for the amount of roots which it emits, compared with those of the domesticated plum; but in the case of these budded trees, the roots seemed not to have increased from what they were probably last spring, while the tops were larger than those not budded." JAMES PARKER of Mississippi, is quoted as saying:[4] "Plums grafted or budded on the peach stock seem to undergo a different change. It is a fact no less strange than true, that the borer appears to avoid the roots of such trees; the bark and wood of the roots seem to become harder and partake more of the nature of the plum. I find this to be a general rule. I have hunted for the borer in the roots of such trees many times, and could find none, while in neighboring peach trees they were abundant."

Professor W. J. BEAL of Michigan says:[5] "If we cut up a long root of a seedling apple, and insert scions of different varieties, a part on each root, the young trees which result from these grafts will have roots unlike each other. The difference may be very slight or it may be very apparent, The scion, then, influences the form of growth in the root." BENJAMIN P. WARE of Massachusetts is reported as follows:[6] "He supposed the stocks in a nursery were all different, yet if we graft each row with a different kind we shall find that the roots of each row have a uniform character in regard to running down or spreading, having few or many fibers, etc., showing that the scion affects the root of the stock." Mr. C. M. HOVEY of Boston[7] doubted whether anyone could tell Winter Nelis pear by its roots, as some had claimed. This variety does not grow as strong as some others—the Vicar of Winkfield for instance—and in a weak-growing tree the roots will be proportionally weak.

EARLINESS.

Does the stock affect the time of ripening of the fruit produced by the graft? KNIGHT believed that grafted fruits generally ripen somewhat earlier than the same varieties on their own roots, but considered it due

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[1] Report Michigan State Board of Agriculture, 1871, p. 127.
[2] Transactions Massachusetts Horticultural society, 1879, p. 18.
[3] Vol. I, 1846, p. 290.
[4] Horticulturist, 1873, p. 179.
[5] Report Michigan Board of Agriculture, 1876, p. 203.
[6] Transactions Massachusetts Horticultural society, 1879, p. 17.
[7] Transactions Massachusetts Horticultural society, 1880, p. 114.

only to the fact of grafting causing an obstruction in the sap, similar to that which occurs on the removal of a ring of bark. BAILEY[1] believes that a stock which ripens its wood early will cause the fruit produced by the graft to ripen earlier than it otherwise would.

Mr. S. MILLER of Pennsylvania gives in the *Horticulturist* for 1849, p. 191, a number of examples of the stock affecting the earliness of the fruit from the graft. In one case a bud from a twig of Red Magnum Bonum plum was inserted into a stock of the early Mirobalan plum, and another bud from the same twig into a stock of a Late Prune. When the buds came to fruit, the crop on the Mirobalan stock ripened ten days earlier than that on the Prune. He had noticed a similar effect of the stock on the season of ripening in peaches. The editor, A. J. DOWNING, adds that his own observations led him to believe that the nature of the stock exerts a decided influence, not only on the season of ripening, but also (which is the same thing) on the keeping qualities of grafted fruits. Mr. N. K. FLUKE of Iowa states in the Report of the Iowa Horticultural society for 1888, page 234, that De Soto and Imperial Gage plums grafted on the early-ripening Wild Goose ripened no earlier than on other stocks. G. B. BRACKETT states in the same connection that he has never seen any effect of the stock on the ripening of the fruit.

Mr. D. T. FISH of England says:[2] "Grape-growers in this country have observed and recorded various changes in form, quality and flavor evidently arising from the stock. The time of ripening, however, of most fruits, seems more stringently fixed than many of their other qualities."

JAMES SHEPPARD of England states:[3] "We have a couple of Muscat vines worked on the Black Hamburgh, and in the same house we have a Muscat on its own roots. Those worked on the Hamburgh started fully five or six days in advance of the one on its own roots, although they are nearly a fortnight behind the Hamburghs they are worked on, each of which has a rod of its own, in addition to the Muscat worked on it. The stock would therefore appear to have forwarded the Muscat about a week; although I have never seen any difference in the ripening of the two, nor any effect on the fruit, yet the growth appears more robust and the leaves of better texture. In the late house we have a Hamburgh worked on Lady Downe's. The Hamburgh has shoots varying from three to six inches in length, in exactly the same stage as the other Hamburghs in the same house, while the rod of Lady Downe's, filling the next rafter, on the same roots that the Hamburgh has to draw its supply of sap from, is only just starting its buds; showing clearly, in this case, that the lateness of the stock has had no influence in retarding the earlier habit of the Hamburgh.

In *Orchard and Garden* for 1890, page 218, Mr. C. LAUPPE says: "About ten years ago I grafted the Lady grape upon Isabella with the result that it now ripens from one week to ten days later. I have the Lady on its own roots within one hundred feet of the grafted vine and am thus enabled to make accurate comparison."

In the *Revue Horticole* for 1890, page 182, M. BONNIER states that the peach on the apricot grows more rapidly than on the plum or almond and yeilds more and finer fruit which ripens six to twelve days earlier than on those stocks.

G. W. MERRIOTT states[4] that the Rokeby pear is a fortnight earlier on the quince than as a standard.

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[1] Garden and Forest, 1890, p. 101.
[2] The Garden. Vol. XX, 1881, p. 591.
[3] Gardeners' Chronicle, 1873, p. 543.
[4] The Garden, Vol. IV, 1873, p. 255.

L. H. BAILEY says[1] an experiment with Winter Nelis pear, showed that the fruit kept longer when grown upon Bloodgood stocks than when grown upon Flemish Beauty stocks. The latter stocks in this case evidently completed their growth sooner than the others.

Mr. WASHBURN of Massachusetts is quoted as saying[2] that his Bartlett pears all ripened about the middle of September, except those grafted on the Easter Beurré, not one of which was ripe September 12.

E. L. STURTEVANT quotes[3] the following statement of STEPHEN ADAMS from the *Germantown Telegraph:* "A few years ago I cut off most of the limbs of my Jargonelle and Vicar of Winkfield and grafted both with Clapp's Favorite. They have commenced to bear, and those on the Jargonelle are two or three weeks earlier than those on the Vicar."

WILLIAM HILL of Massachusetts says:[4] "Some years ago we grafted the Styrian or Keele Hall Beurré pear on the Citron des Carmes, which is one of our earliest summer pears, and the result is that the Styrian thus treated is about three weeks earlier than the same kind on the ordinary pear stock and better flavored."

C. M. HOVEY[5] states that he has grafted late varieties of pear on the Madeleine and other early varieties without hastening their ripening, and he doubted the statement that this effect was produced on the Styrian or Keele Hall pear when grafted on the Madeleine. He also says[6] that he has "never found the Bartlett to become earlier by grafting it on the very early sort known as Amire Joannet, or later by grafting on the Vicar of Winkfield. He had grafted Clapp's Favorite on Jargonelle Dix, Beurré d' Aremberg, Columbia, Glout Morceau, Beurré Diel, and Flemish Beauty Dana's Hovey on Gustin's Summer, Harvard, and Vicar of Winkfield; and Bartlett on Winter Nelis, Easter Beurré, Green Chisel, and Onondaga, without changing the season of ripening in the least."

M. T. MASTERS, editor of *Gardeners' Chronicle*, states[7] that pears ripen earlier on the mountain ash than on pear stocks. A. J. DOWNING says[8] that pears so grown keep longer, which would hardly be expected if they ripened earlier. Hornby is quoted[9] as saying that pears grafted on the mountain ash were retarded in flowering. Another writer, however, in the same connection stated that in his experiments he had not observed that the blossoms were retarded.

In the report of the United States Department of Agriculture for 1865, page 202, W. C. LODGE says: "The apple is rarely used to give roots to the pear. In a few instances, however, the effect of the apple roots upon the pear has been astonishing. Mr. PERKINS of New Jersey, in experimenting with various stocks, used the scion of a superior variety of the hedge pear, thick skinned and late in ripening. On apple roots he found the pear grown to more than twice its largest size on its own roots, and when carefully picked and house-ripened, proved to be the finest winter pear, being a fine orange color with tender flesh, exceedingly rich and juicy."

There is considerable testimony that in apples stocks of early varieties tend to hasten the maturity of fruits grafted upon them. Mr. D. T. FISH of England, states[10] that Paradise stock tends at times to hasten maturity,

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1 Garden and Forest, 1890, p. 101.
2 Trans. Mass. Hort. Soc., 1880, p. 115.
3 Proceedings Mass. Hort. Soc., 1880, p. 97.
4 The Garden, 1873, p. 334.
5 Proceedings Mass. Hort. Soc., 1880, p. 104.
6 Country Gentleman, 1881, p. 678.
7 Encyclopedia Britannica, 9th ed., 1881, Vol. XII, p. 213.
8 Fruits and Fruit Trees of America, 1869, p. 29.
9 Gardener's Magazine, 1842, p. 228.
10 The Garden, Vol. XX, 1881, p. 591.

much fewer seeds than usual. He also grafted the artichoke upon the common sunflower and produced upon the stem of the latter, above the graft but near the ground, tuberous swellings like those of the dahlia. Mr. MAULE,[1] an English gardener, states that he grafted the potato upon the bitter-sweet and produced tubers on the roots of the latter. Professor BEAL of Michigan records[2] that some one set a potato scion in a tomato plant and induced the latter to form small tubers in the axils of its leaves. Director SPEER of the Iowa experiment station, says that a feeble graft often induces in the roots of the stock a tendency to throw up suckers, and that this tendency may be checked by regrafting the stock with a vigorous variety. Professor KIRTLAND of Ohio says[3] that "a graft of the Green Newton Pippin will invariably render the bark of the stock rough and black (the habit of the variety) within three years after its insertion." The Leon le Clerc pear is given as another example of a variety which has been observed to modify the character of the bark of the stock.[4]

No effect of the scion on the stock is more remarkable than the often noticed influence on the character of the roots. A writer from Plymouth, Michigan, says:[5] "In the nursery where we take pieces of seedling apple roots, and graft scions of different varieties of apple on them, the roots in one year partake of the characteristics of the variety grafted in. A variety having a straight, upright top sends down a few correspondingly straight roots. A variety with a thick, spreading top makes numerous spreading roots. * * * Where buds are put into two-year-old seedling apple trees, the seedlings being variable, it requires several years to change the roots, to make the nursery trees of a variety similar, and the time required to change with a weak-growing graft is greater than with a strong-grower, the trunk and roots still performing their office for the original variety."

"The graft," says C. A. GREEN of Rochester, N. Y., in the *New York Tribune*,[6] "has a remarkable effect on the roots of the stock. In starting apple trees in the nursery we graft on roots of seedlings, all of which, if unaffected by the graft, would exhibit no especial character; but when we dig these roots, after being affected by the graft for three or four years, we find that those grafted with Red Astrachan, for instance, are very fibrous, branching out near the surface with few tap roots, while the rows adjoining, or parts of the same row, grafted with the Duchess of Oldenburg, or the Fameuse, are destitute of fibers, possess only three coarse prongs, as a rule, one of which is liable to be a tap root, seeking an abode far down in the subsoil. It takes my men twice as long to dig a row of Fameuse or Duchess as a row of Red Astrachan, and when planted the roots of all were of the same character." J. B. MOORE of Massachusetts, says:[7] "Every nurseryman knows that the character of roots is changed, and that the roots of a row of Baldwin apple trees in the nursery will be alike, and the roots of a row of Roxbury Russets will be alike, and will differ from those of the Baldwins." O. B. HADWIN adds, in the same connection, that "if part of the same lot of pear stocks are grafted with Bartletts and a part with Onondaga, the two varieties can be distinguished by

[1] Gardeners' Chronicle, 1876, pp. 532, 538.
[2] Report Mich. State Board of Agriculture, 1876, p. 204.
[3] Horticulturist, Vol. II, p. 544.
[4] Josiah Hoops, Proc. Am. Pom. Soc., 1873, p. 130.
[5] Country Gentlemen, 1882, p. 312.
[6] Quoted in Rural New Yorker, 1880, p. 506.
[7] Transactions Massachusetts Harticultural society, 1880, p. 109.

the roots." Benjamin Hathaway of Michigan says:[1] "Not only are root-grafts of this [Northern Spy] certain to root from the graft, but when budded or grafted on seedlings it will develop in them a tendency to form a great many fibrous roots." J. W. Talbot of Massachusetts, said:[2] "If the Siberian Crab is grafted on any number of stocks the roots will all run down." E. G. Partridge of Wisconsin, says in speaking of grafting apples on the wild crab (Transactions Wisconsin Horticultural Society, 1881–2, p. 38): "If we start with the crab root we shall in time have the top standing on its own roots, the old roots gradually dying out, or on roots from which the original properties and characteristics have been eliminated." A writer in the *Horticulturist* says:[3] "Upon removing the plants from a bed of seedling Canada plums (the wild red plum of our woods), about a hundred of which were budded last summer with the Imperial Gage, Red Gage, end Jefferson plums, and which had made a growth of four or five feet the present season, and were quite stocky, I found that the amount of roots of the budded trees was less that half of those remaining unbudded, and the color was a shade deeper. The Canada plum is remarkable for the amount of roots which it emits, compared with those of the domesticated plum; but in the case of these budded trees, the roots seemed not to have increased from what they were probably last spring, while the tops were larger than those not budded." James Parker of Mississippi, is quoted as saying:[4] "Plums grafted or budded on the peach stock seem to undergo a different change. It is a fact no less strange than true, that the borer appears to avoid the roots of such trees; the bark and wood of the roots seem to become harder and partake more of the nature of the plum. I find this to be a general rule. I have hunted for the borer in the roots of such trees many times, and could find none, while in neighboring peach trees they were abundant."

Professor W. J. Beal of Michigan says:[5] "If we cut up a long root of a seedling apple, and insert scions of different varieties, a part on each root, the young trees which result from these grafts will have roots unlike each other. The difference may be very slight or it may be very apparent. The scion, then, influences the form of growth in the root." Benjamin P. Ware of Massachusetts is reported as follows:[6] "He supposed the stocks in a nursery were all different, yet if we graft each row with a different kind we shall find that the roots of each row have a uniform character in regard to running down or spreading, having few or many fibers, etc., showing that the scion affects the root of the stock." Mr. C. M. Hovey of Boston[7] doubted whether anyone could tell Winter Nelis pear by its roots, as some had claimed. This variety does not grow as strong as some others—the Vicar of Winkfield for instance—and in a weak-growing tree the roots will be proportionally weak.

EARLINESS.

Does the stock affect the time of ripening of the fruit produced by the graft? Knight believed that grafted fruits generally ripen somewhat earlier than the same varieties on their own roots, but considered it due

1 Report Michigan State Board of Agriculture, 1871, p. 127.
2 Transactions Massachusetts Horticultural society, 1879, p. 18.
3 Vol. I, 1846, p. 290.
4 Horticulturist, 1873, p. 179.
5 Report Michigan Board of Agriculture, 1876, p. 203.
6 Transactions Massachusetts Horticultural society, 1879, p. 17.
7 Transactions Massachusetts Horticultural society, 1880, p. 114.

only to the fact of grafting causing an obstruction in the sap, similar to that which occurs on the removal of a ring of bark. BAILEY[1] believes that a stock which ripens its wood early will cause the fruit produced by the graft to ripen earlier than it otherwise would.

Mr. S. MILLER of Pennsylvania gives in the *Horticulturist* for 1849, p. 191, a number of examples of the stock affecting the earliness of the fruit from the graft. In one case a bud from a twig of Red Magnum Bonum plum was inserted into a stock of the early Mirobalan plum, and another bud from the same twig into a stock of a Late Prune. When the buds came to fruit, the crop on the Mirobalan stock ripened ten days earlier than that on the Prune. He had noticed a similar effect of the stock on the season of ripening in peaches. The editor, A. J. DOWNING, adds that his own observations led him to believe that the nature of the stock exerts a decided influence, not only on the season of ripening, but also (which is the same thing) on the keeping qualities of grafted fruits. Mr. N. K. FLUKE of Iowa states in the Report of the Iowa Horticultural society for 1888, page 234, that De Soto and Imperial Gage plums grafted on the early-ripening Wild Goose ripened no earlier than on other stocks. G. B. BRACKETT states in the same connection that he has never seen any effect of the stock on the ripening of the fruit.

Mr. D. T. FISH of England says:[2] "Grape-growers in this country have observed and recorded various changes in form, quality and flavor evidently arising from the stock. The time of ripening, however, of most fruits, seems more stringently fixed than many of their other qualities."

JAMES SHEPPARD of England states:[3] "We have a couple of Muscat vines worked on the Black Hamburgh, and in the same house we have a Muscat on its own roots. Those worked on the Hamburgh started fully five or six days in advance of the one on its own roots, although they are nearly a fortnight behind the Hamburghs they are worked on, each of which has a rod of its own, in addition to the Muscat worked on it. The stock would therefore appear to have forwarded the Muscat about a week; although I have never seen any difference in the ripening of the two, nor any effect on the fruit, yet the growth appears more robust and the leaves of better texture. In the late house we have a Hamburgh worked on Lady Downe's. The Hamburgh has shoots varying from three to six inches in length, in exactly the same stage as the other Hamburghs in the same house, while the rod of Lady Downe's, filling the next rafter, on the same roots that the Hamburgh has to draw its supply of sap from, is only just starting its buds; showing clearly, in this case, that the lateness of the stock has had no influence in retarding the earlier habit of the Hamburgh.

In *Orchard and Garden* for 1890, page 218, Mr. C. LAUPPE says: "About ten years ago I grafted the Lady grape upon Isabella with the result that it now ripens from one week to ten days later. I have the Lady on its own roots within one hundred feet of the grafted vine and am thus enabled to make accurate comparison."

In the *Revue Horticole* for 1890, page 182, M. BONNIER states that the peach on the apricot grows more rapidly than on the plum or almond and yeilds more and finer fruit which ripens six to twelve days earlier than on those stocks.

G. W. MERRIOTT states[4] that the Rokeby pear is a fortnight earlier on the quince than as a standard.

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1 Garden and Forest, 1890, p. 101.
2 The Garden. Vol. XX, 1881, p. 591.
3 Gardeners' Chronicle, 1873, p. 543.
4 The Garden, Vol. IV, 1873, p. 255.

L. H. BAILEY says[1] an experiment with Winter Nelis pear, showed that the fruit kept longer when grown upon Bloodgood stocks than when grown upon Flemish Beauty stocks. The latter stocks in this case evidently completed their growth sooner than the others.

Mr. WASHBURN of Massachusetts is quoted as saying[2] that his Bartlett pears all ripened about the middle of September, except those grafted on the Easter Beurré, not one of which was ripe September 12.

E. L. STURTEVANT quotes[3] the following statement of STEPHEN ADAMS from the *Germantown Telegraph:* "A few years ago I cut off most of the limbs of my Jargonelle and Vicar of Winkfield and grafted both with Clapp's Favorite. They have commenced to bear, and those on the Jargonelle are two or three weeks earlier than those on the Vicar."

WILLIAM HILL of Massachusetts says:[4] "Some years ago we grafted the Styrian or Keele Hall Beurré pear on the Citron des Carmes, which is one of our earliest summer pears, and the result is that the Styrian thus treated is about three weeks earlier than the same kind on the ordinary pear stock and better flavored."

C. M. HOVEY[5] states that he has grafted late varieties of pear on the Madeleine and other early varieties without hastening their ripening, and he doubted the statement that this effect was produced on the Styrian or Keele Hall pear when grafted on the Madeleine. He also says[6] that he has "never found the Bartlett to become earlier by grafting it on the very early sort known as Amire Joannet, or later by grafting on the Vicar of Winkfield. He had grafted Clapp's Favorite on Jargonelle Dix, Beurré d' Aremberg, Columbia, Glout Morceau, Beurré Diel, and Flemish Beauty Dana's Hovey on Gustin's Summer, Harvard, and Vicar of Winkfield; and Bartlett on Winter Nelis, Easter Beurré, Green Chisel, and Onondaga, without changing the season of ripening in the least."

M. T. MASTERS, editor of *Gardeners' Chronicle*, states[7] that pears ripen earlier on the mountain ash than on pear stocks. A. J. DOWNING says[8] that pears so grown keep longer, which would hardly be expected if they ripened earlier. Hornby is quoted[9] as saying that pears grafted on the mountain ash were retarded in flowering. Another writer, however, in the same connection stated that in his experiments he had not observed that the blossoms were retarded.

In the report of the United States Department of Agriculture for 1865, page 202, W. C. LODGE says: "The apple is rarely used to give roots to the pear. In a few instances, however, the effect of the apple roots upon the pear has been astonishing. Mr. PERKINS of New Jersey, in experimenting with various stocks, used the scion of a superior variety of the hedge pear, thick skinned and late in ripening. On apple roots he found the pear grown to more than twice its largest size on its own roots, and when carefully picked and house-ripened, proved to be the finest winter pear, being a fine orange color with tender flesh, exceedingly rich and juicy."

There is considerable testimony that in apples stocks of early varieties tend to hasten the maturity of fruits grafted upon them. Mr. D. T. FISH of England, states[10] that Paradise stock tends at times to hasten maturity,

1 Garden and Forest, 1890, p. 101.
2 Trans. Mass. Hort. Soc., 1880, p. 115.
3 Proceedings Mass. Hort. Soc., 1880, p. 97.
4 The Garden, 1873, p. 334.
5 Proceedings Mass. Hort. Soc., 1880, p. 104.
6 Country Gentleman, 1881, p. 678.
7 Encyclopedia Britannica, 9th ed., 1881, Vol. XII, p. 213.
8 Fruits and Fruit Trees of America, 1869, p. 29.
9 Gardener's Magazine, 1842, p. 228.
10 The Garden, Vol. XX, 1881, p. 591.

Phillip Miller, in his "Gardeners' Dictionary," 1731, under "Pyrus," says that the fruit of the pear upon the quince and white thorn is commonly dryer and more likely to be mealy than when on pear stocks. On quince stocks, he says: "All the sorts of hard, breaking pears are rendered stony and good for little." On the contrary, "all melting, buttery pears are greatly improved by being upon quince stocks, provided they are planted on a strong soil."

G. W. Merriott, in the *Garden*, volume IV, 1873, page 255, says the Rokeby pear on pear stocks "was in every stage of ripening very bad, being dry and mealy; while the same sort worked on the quince, in the same ground, was full of juice, melting and deliciously flavored, and was a fortnight earlier."

E. W. Wood, in the Transactions of the Massachusetts Horticultural Society for 1879, page 26, said: "On pear stocks the Duchess d'Angouleme is knurly and inferior, while on the quince stock it is fair and good. The same difference is seen in the Louise Bonne of Jersey. The quince stock also affects the time of bearing. The Urbaniste, which requires from twelve to fifteen years to come into bearing on the pear, requires only five or six on the quince."

A writer in the *Garden* for 1874, page 245, gives the following account of the effect of different stocks on the Josephine de Malines pear: "One of the richest of Christmas pears is Josephine de Malines, and it is also one of the hardiest, ripening here—a very exposed situation in Norfolk, not far from the coast—on bushes in the open ground. It seems, however, to be a pear peculiarly susceptible of influence from the stock on which it is worked. It is here on the quince, grafted on the common pear stock, and on its own roots, a pendent bough which touched the earth having become layered and thrown out roots. In the first form [on the quince], it bears early; but the fruit, luscious, is somewhat under-size. The wasps attack it first of all. On the ordinary pear stock, at ten years old, it has not fruited. On the hawthorn the shoots are thinner than on either of the preceding; it has had fruit twice, but they did not become soft. So far it is not a success. On its own roots it has fruited three times (same age as others) and the fruit is very unlike that of the parent from which the bough rooted. The fruit is somewhat larger, less covered with russet, greener in hue, more vinous, and less honey-sweet. It is also later in ripening. This day (March 2), I have been examining the trees. On the ordinary pear stock, if there be blossom buds they are so backward that they can not be easily discerned; on the hawthorn, ditto; on the quince the knots of bloom are very perceptible—as forward as Doyenné d' Eté—the earliest pear on its own roots; but the blossoms are almost ready to expand—the forwardest in a collection of about thirty kinds—very abundant, too, which is the first time they have been so. In the previous nine years of its separate existence the blossoms have heen sparse, but have set fairly. Our trial goes to show that Josephine de Malines, is best left to itself—*i. e.*, on its own roots—but is a good pear on the quince."

A few observations have been made on the effect of different stocks on the fruit of grapes: A writer in the *Gardeners' Chronicle*, 1871, page 1,100, states that he has seen black grapes altered in flavor, size, and color by being grafted on white varieties. The black grape, Mrs. Pince, had had its berries and bunches grown out of normal character and its flavor spoiled by being grafted on the white grapes, Nice and Syrian. W. B. Carpenter, in his "Vegetable Physiology" (1873), page 195, says: "The

more delicate kinds of vine produce larger and finer grapes when worked upon coarser and more robust kinds.

M. TEMPLE says in the *Florist and Pomologist*, 1881, p. 169: "The Duchess of Buccleuch, though a small berry, is of exquisite flavor. This kind I once grafted on a West St. Peters, which so changed its character for size of berry that it could scarcely be recognized."

F. W. BURBIDGE, in his work on "Propagation of Plants," page 63, says: At Battle Abbey are rods of Canon Hall and Muscat of Alexandria worked side by side on the Royal Muscadine stock, and the result is compact, well set bunches, far superior to those borne by the same varieties on their own roots, and otherwise in precisely the same conditions. He states that Golden Champion on its own roots is frequently blotched or spotted in the berry and eventually rots if not cut when it ripens, this perhaps being due to its "low maturative force." On the Raisin de Calabre, however, in point of color, finish, and flavor, this grape is well nigh perfect.

In regard to the effect of different stocks on the peach, THOMAS ANDREW KNIGHT stated, in 1823, in the Transactions of the London Horticultural Society, volume V, page 289: "I have also some reasons for believing that the quality of the fruit of the peach tree is, in some cases at least, much deteriorated by the operation of the plum stock. My garden contains two peach trees of the same variety, the Acton Scott, one growing upon its native stock and the other upon a plum stock, the soil being very similar, and the aspect the same. That growing upon the plum stock affords fruit of a larger size, and its color, where it is exposed to the sun, is much more red; but its pulp is more coarse, and its taste and flavor so inferior that I should be disposed to deny the identity of the variety if I had not inserted the buds from which both sprang with my own hand." Two trees of the Moorpark apricot upon apricot stocks produced fruit much more succulent and melting than the trees usually grown upon plum stocks.

H. F. HILLENMEYER of Lexington, Kentucky, states that in his experience the peach on plum stocks becomes unhealthy, and though the crops were full the quality of the fruit was inferior.

M. T. MASTERS says:[1] "The form, and especially the quality, of fruit is more or less affected by the stock upon which it is grown. The Stanwick nectarine, so apt to crack and not to ripen when worked in the ordinary way, is said to be cured of these propensities by being first budded close to the ground, on the very strong-growing Magnum Bonum plum, worked on a Brussels stock, and by then budding the nectarine on the Magnum Bonum about a foot from the ground."

A. J. DOWNING, in his "Fruits and Fruit Trees of America" (1869), page 29, says: "The Green Gage, a plum of great delicacy of flavor, varies considerably upon different stocks."

A correspondent of *Coleman's Rural World*, says:[2] "I once grafted an English wild cherry on a wild cherry stock. When it came into bearing it bore cherries about two-thirds the size of the English cherry, the color

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[1] Encyclopedia Britannica, 9th edition, Vol. XII, 1881, page 213.
[2] Quoted in Horticulturist, 1873, p. 87.

of the fruit red, and the flavor near that of the wild cherry, viz.: bitter. Another time I took scions of an Early May cherry, and grafted part of them on Mazzard stocks. When the trees came into bearing the fruit was so different that each kind might have been called a different variety from the other."

The editor of the *Revue Horticole* records in that journal for 1889, page 515, that upon a Bigarreau Esperen cherry, a crisp, late variety, was grafted the Heart variety, Rouge de Mai, which is very early and bears nearly hemispherical, not crisp but very sweet, fruit. The fruits borne by the grafts, however, were more elongated, strongly crisp and relatively acerb.

Regarding citrus fruits, Dr. E. L. STURTEVANT[1] quotes from the Report of the Southern California Horticultural Society, Vol. II, page 78, a report of a committee of that society upon the result of budding the Navel orange on the citron, lime, and China lemon, in which it was stated that in each case the fruit showed marked and distinct characteristics derived from the stocks.

B. M. LELONG, in his "Citrus Culture in California," 1888, page 77, says of the Chinese lemon: "This variety was extensively cultivated in California as a stock for budding the orange upon. This practice was soon abandoned, for it was found by practical experience that the fruit grown upon it was very coarse and sour. · · · The root is not strong enough to hold the weight of the top made by the orange," and soon begins to decay.

The same author states (p. 82): "It has been claimed that if the lemon be budded on anything but lemon stock, the lemons will lose their elongated shape, and that they will become roundish, especially if budded on the orange. I have often observed roundish lemons on trees budded on orange stock, but they are so few that it is hardly noticeable. · · · The quality of the lemon on orange stock can not be surpassed."

In the Transactions of the Massachusetts Horticultural Society for 1879, page 23, Mr. J. W. TALBOT said that he saw in the newspapers a statement that in Florida oranges grafted on wild stocks revert to the wild form in a few years.

In the same connection, page 32, Mr. H. MERRIMAN states that in Florida the Indian River orange grows true from seed, while the inferiority of many kinds there grown is due to budding on the wild orange, on which the trees come into bearing earlier and are more hardy. The fruit of grafts on these sour oranges depreciates, he says, with age, and the oldest orchards he had seen had given the poorest fruit. In the Transactions of the same society for 1880, pages 174–6, Messrs. E. H. and W. S. HART of Florida deny that improved varieties of the orange deteriorate in quality as a result of budding on the sour orange. The former gentleman also states that the Indian River oranges owe their superiority, not to the fact of their being a single superior variety, but largely to the congenial soil and climate, which improves the quality of various varieties there grown.

The U. S. Department of Agriculture recently sent a circular to orange-growers in Florida, inquiring as to the comparative value of sweet and sour stock for oranges. A few replies stated that the quality was better on the sweet stock, and a few that it was better on the sour stock, but most of the leading growers had noticed no difference in the quality of the fruit from the different stocks.

[1] Transactions Massachusetts Horticultural Society, 1880, p. 95.

Woodrow, in his "Gardening in India" (1888), p. 189, says: "Much has been written regarding the sweet lime as a stock for orange trees, and nearly all who notice the subject take it for granted that it will increase the sweetness of an orange. . . . I have been very carefully searching for any definite results on this subject attained by others, but without success."

In Palestine the orange is budded on the sweet lemon, apparently because it furnishes vigorous, healthy stocks. (Scientific American Supplement, 1885, page 7958.)

In Sicily, apparently for the same reason, the orange and lemon are both budded on the sour orange. (Ib., 1886, p. 8454). The following account of the effect of different stocks on the tree and fruit of the Mandarin is taken from the *Revue Horticole* for 1885, page 265: "We have received from our collaborator, M. Pfrimmer of Misserghin (Algeria), the following interesting communication: Upon reading what was said in the *Revue Horticole* upon 'Double Working and its influences on Vegetation,' I thought I would cite an example of the same kind. As every one knows, in Algeria when they graft the Mandarin (*Citrus nobilis*) upon the citron it grows in a surprising manner the first year. The second year it fruits abundantly, but during the third year it dies. We also know that grafts of the Mandarin on the Cedrat grow very poorly, owing to the fact that the suckers of the Cedrat have no tap root and few fibers. A dozen years ago I grafted several Cedrats and Mandarins which remain today in a condition of poor shrubs not over two feet in height, while some sour orange seedlings which were eight years ago grafted at six years of age to Mandarins, form today magnificent trees nine to twelve feet high, full of health, and loaded with golden fruit all winter. The same difference is seen in the fruits. Those coming from the grafts on the Cedrat have the flesh woody, granular, and coarse-grained, while those from the grafts on the sour orange have fine, juicy, and melting flesh. Having at my disposal a strong citron tree on which we preferred to grow Mandarins, I had recourse to double grafting. The direct graft gave only negative results, as I expected. I first grafted a Cedrat on the Citron, and in the same year placed buds of Mandarin on the young shoots of the Cedrat. The result fully equaled my expectation, and for more than seven years I have gathered good fruit from the tree so grafted.

COLOR.

In the preceding section, a number of cases were incidentally mentioned where grafted fruits were darker or lighter in color according to the color of the fruit of the stocks upon which they were grown. Knight regarded the heightened color often exhibited by grafted fruits to be due only to accelerated ripening, resulting from the mechanical obstruction of the sap produced by grafting. Bailey [1] considers that early maturing stocks may cause the fruit of grafts to ripen earlier and so become more highly colored. Some of the cases already quoted can not be accounted for by either of these causes, and the following additional cases mainly of the transfer of color in leaf and stem between stock and graft support the belief that the stock may more directly modify the color of grafted fruits.

M. T. Masters, in his Teratology, pages 50–2, says: "Lindley cites the case wherein two carrots, of the White Belgian and Red Surrey varieties respectively, had grown so close to each other that each twisted half round

[1] Garden and Forest, 1890, page 101.

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more delicate kinds of vine produce larger and finer grapes when worked upon coarser and more robust kinds.

M. TEMPLE says in the *Florist and Pomologist*, 1881, p. 169: "The Duchess of Buccleuch, though a small berry, is of exquisite flavor. This kind I once grafted on a West St. Peters, which so changed its character for size of berry that it could scarcely be recognized."

F. W. BURBIDGE, in his work on "Propagation of Plants," page 63, says: At Battle Abbey are rods of Canon Hall and Muscat of Alexandria worked side by side on the Royal Muscadine stock, and the result is compact, well set bunches, far superior to those borne by the same varieties on their own roots, and otherwise in precisely the same conditions. He states that Golden Champion on its own roots is frequently blotched or spotted in the berry and eventually rots if not cut when it ripens, this perhaps being due to its "low maturative force." On the Raisin de Calabre, however, in point of color, finish, and flavor, this grape is well nigh perfect.

In regard to the effect of different stocks on the peach, THOMAS ANDREW KNIGHT stated, in 1823, in the Transactions of the London Horticultural Society, volume V, page 289: "I have also some reasons for believing that the quality of the fruit of the peach tree is, in some cases at least, much deteriorated by the operation of the plum stock. My garden contains two peach trees of the same variety, the Acton Scott, one growing upon its native stock and the other upon a plum stock, the soil being very similar, and the aspect the same. That growing upon the plum stock affords fruit of a larger size, and its color, where it is exposed to the sun, is much more red; but its pulp is more coarse, and its taste and flavor so inferior that I should be disposed to deny the identity of the variety if I had not inserted the buds from which both sprang with my own hand." Two trees of the Moorpark apricot upon apricot stocks produced fruit much more succulent and melting than the trees usually grown upon plum stocks.

H. F. HILLENMEYER of Lexington, Kentucky, states that in his experience the peach on plum stocks becomes unhealthy, and though the crops were full the quality of the fruit was inferior.

M. T. MASTERS says:[1] "The form, and especially the quality, of fruit is more or less affected by the stock upon which it is grown. The Stanwick nectarine, so apt to crack and not to ripen when worked in the ordinary way, is said to be cured of these propensities by being first budded close to the ground, on the very strong-growing Magnum Bonum plum, worked on a Brussels stock, and by then budding the nectarine on the Magnum Bonum about a foot from the ground."

A. J. DOWNING, in his "Fruits and Fruit Trees of America" (1869), page 29, says: "The Green Gage, a plum of great delicacy of flavor, varies considerably upon different stocks."

A correspondent of *Coleman's Rural World*, says:[2] "I once grafted an English wild cherry on a wild cherry stock. When it came into bearing it bore cherries about two-thirds the size of the English cherry, the color

[1] Encyclopedia Britannica, 9th edition, Vol. XII, 1881, page 213.
[2] Quoted in Horticulturist, 1873, p. 87.

of the fruit red, and the flavor near that of the wild cherry, viz.: bitter. Another time I took scions of an Early May cherry, and grafted part of them on Mazzard stocks. When the trees came into bearing the fruit was so different that each kind might have been called a different variety from the other."

The editor of the *Revue Horticole* records in that journal for 1889, page 515, that upon a Bigarreau Esperen cherry, a crisp, late variety, was grafted the Heart variety, Rouge de Mai, which is very early and bears nearly hemispherical, not crisp but very sweet, fruit. The fruits borne by the grafts, however, were more elongated, strongly crisp and relatively acerb.

Regarding citrus fruits, Dr. E. L. STURTEVANT[1] quotes from the Report of the Southern California Horticultural Society, Vol. II, page 78, a report of a committee of that society upon the result of budding the Navel orange on the citron, lime, and China lemon, in which it was stated that in each case the fruit showed marked and distinct characteristics derived from the stocks.

B. M. LELONG, in his "Citrus Culture in California," 1888, page 77, says of the Chinese lemon: "This variety was extensively cultivated in California as a stock for budding the orange upon. This practice was soon abandoned, for it was found by practical experience that the fruit grown upon it was very coarse and sour. * * * The root is not strong enough to hold the weight of the top made by the orange," and soon begins to decay.

The same author states (p. 82): "It has been claimed that if the lemon be budded on anything but lemon stock, the lemons will lose their elongated shape, and that they will become roundish, especially if budded on the orange. I have often observed roundish lemons on trees budded on orange stock, but they are so few that it is hardly noticeable. * * * The quality of the lemon on orange stock can not be surpassed."

In the Transactions of the Massachusetts Horticultural Society for 1879, page 23, Mr. J. W. TALBOT said that he saw in the newspapers a statement that in Florida oranges grafted on wild stocks revert to the wild form in a few years.

In the same connection, page 32, Mr. H. MERRIMAN states that in Florida the Indian River orange grows true from seed, while the inferiority of many kinds there grown is due to budding on the wild orange, on which the trees come into bearing earlier and are more hardy. The fruit of grafts on these sour oranges depreciates, he says, with age, and the oldest orchards he had seen had given the poorest fruit. In the Transactions of the same society for 1880, pages 174–6, Messrs. E. H. and W. S. HART of Florida deny that improved varieties of the orange deteriorate in quality as a result of budding on the sour orange. The former gentleman also states that the Indian River oranges owe their superiority, not to the fact of their being a single superior variety, but largely to the congenial soil and climate, which improves the quality of various varieties there grown.

The U. S. Department of Agriculture recently sent a circular to orange-growers in Florida, inquiring as to the comparative value of sweet and sour stock for oranges. A few replies stated that the quality was better on the sweet stock, and a few that it was better on the sour stock, but most of the leading growers had noticed no difference in the quality of the fruit from the different stocks.

[1] Transactions Massachusetts Horticultural Society, 1880, p. 95.

Woodrow, in his "Gardening in India" (1888), p. 189, says: "Much has been written regarding the sweet lime as a stock for orange trees, and nearly all who notice the subject take it for granted that it will increase the sweetness of an orange. . . . I have been very carefully searching for any definite results on this subject attained by others, but without success."

In Palestine the orange is budded on the sweet lemon, apparently because it furnishes vigorous, healthy stocks. (Scientific American Supplement, 1885, page 7958.)

In Sicily, apparently for the same reason, the orange and lemon are both budded on the sour orange. (Ib., 1886, p. 8454). The following account of the effect of different stocks on the tree and fruit of the Mandarin is taken from the *Revue Horticole* for 1885, page 265: "We have received from our collaborator, M. Pfrimmer of Misserghin (Algeria), the following interesting communication: Upon reading what was said in the *Revue Horticole* upon 'Double Working and its influences on Vegetation,' I thought I would cite an example of the same kind. As every one knows, in Algeria when they graft the Mandarin (*Citrus nobilis*) upon the citron it grows in a surprising manner the first year. The second year it fruits abundantly, but during the third year it dies. We also know that grafts of the Mandarin on the Cedrat grow very poorly, owing to the fact that the suckers of the Cedrat have no tap root and few fibers. A dozen years ago I grafted several Cedrats and Mandarins which remain today in a condition of poor shrubs not over two feet in height, while some sour orange seedlings which were eight years ago grafted at six years of age to Mandarins, form today magnificent trees nine to twelve feet high, full of health, and loaded with golden fruit all winter. The same difference is seen in the fruits. Those coming from the grafts on the Cedrat have the flesh woody, granular, and coarse-grained, while those from the grafts on the sour orange have fine, juicy, and melting flesh. Having at my disposal a strong citron tree on which we preferred to grow Mandarins, I had recourse to double grafting. The direct graft gave only negative results, as I expected. I first grafted a Cedrat on the Citron, and in the same year placed buds of Mandarin on the young shoots of the Cedrat. The result fully equaled my expectation, and for more than seven years I have gathered good fruit from the tree so grafted.

COLOR.

In the preceding section, a number of cases were incidentally mentioned where grafted fruits were darker or lighter in color according to the color of the fruit of the stocks upon which they were grown. Knight regarded the heightened color often exhibited by grafted fruits to be due only to accelerated ripening, resulting from the mechanical obstruction of the sap produced by grafting. Bailey [1] considers that early maturing stocks may cause the fruit of grafts to ripen earlier and so become more highly colored. Some of the cases already quoted can not be accounted for by either of these causes, and the following additional cases mainly of the transfer of color in leaf and stem between stock and graft support the belief that the stock may more directly modify the color of grafted fruits.

M. T. Masters, in his Teratology, pages 50–2, says: "Lindley cites the case wherein two carrots, of the White Belgian and Red Surrey varieties respectively, had grown so close to each other that each twisted half round

[1] Garden and Forest, 1890, page 101.

the other, so that they ultimately become soldered together; the most singular thing with reference to this union was, that the red carrot with its small, overgrown part above the juncture, took the color and large dimensions of the White Belgian, which, in like manner, with its larger head above the joining, took the color and small dimensions of the red one at and below the union. The respective qualities of the two roots were thus transposed, while the upper portions or crowns were unaffected; the root of one, naturally weak, became distended and enlarged by the abundant matter poured into it by its new crown; and in like manner the root of the other, naturally vigorous, was starved."

In the *Gardeners' Chronicle* for 1878, page 662, is recorded an experiment by M. LINDEMUTH, in which a shoot of a variety of potato having violet-colored foliage was grafted on a shoot of a variety having the the ordinary green foliage. The stock, which had been cut off about three inches from the ground, took on, in about two weeks after the operation, a lively carmine red color, while the growing scion was of a more violet tinge. The author claims to be the first to observe the transfer of coloring matter into a green axis.

In the same journal for 1873, page 645, is a report of some experiments in grafting the potato made by M. MAGNUS of Berlin. "He obtained some young plants from cuttings and grafted them with different varieties. All the tubers produced after the grafting showed the effect of the grafting, especially in the color. When a black variety had been grafted on a white, or a red on a black, and *vice versa*, the new tubers were in point of color intermediate."

In *Garden and Forest*, 1890, page 101, Professor L. H. BAILEY, reports the following case: "*Prunus Pissardi* gave me much more highly colored foliage when grafted upon *Prunus Americana* than upon *Prunus domestica*. The scions came from the same tree, and the grafted trees stood in the same row. Any acceleration in the ripening of fruit is apt to cause high color, but the intensification of color in *Prunus Pissardi* was not due to such cause, as the the grafts were more vigorous upon *Prunus Americana*.

GEORGE W. CAMPBELL of Ohio states in the Report of the Michigan Pomological society for 1877, page 451, that the flowers of a light colored rose grafted on a dark variety became nearly as dark as those of the stock, but that there was no other change.

In the *Revue Horticole* for 1889, page 515, the editor of that journal quotes Wm. Falconer of Long Island as having grafted a Marechal Niel rose with the Mermet and obtained flowers differing from either of these varieties but resembling the Gloire de Dijon. Peter Henderson doubted this.

Dr. M. T. MASTERS exhibited before the Linnæan society of London, in 1869 (Proceedings 1868–9, p. 27), a spray of holly bearing orange-colored berries which was a graft of a yellow-fruited variety on a red-berried stock.

The same writer states in the *Gardeners' Chronicle* for 1872, page 322, that the purple-leaved *Corylus Avellana* sometimes, but not always, transfers its color to the stock when grafted on the ordinary form.

On the other hand, George Paul, in the same journal for 1876, page 474, observed the following case in which a green-leaved stock appeared to partially overcome the variegation of the graft: A scion of the purple birch was winter-grafted on the common birch stock, and from the scion were produced several buds of the purple birch, one of which was allowed to

remain, while the others were removed for the purpose of propagation. An exposed surface or wound was consequently left by the removal of the buds, and from these wounds new or adventitious buds were produced with the peculiarity that their leaves were all green, although produced upon a purple scion.

The following cases may also be given in this connection: Mr. MOEN reports in the *Tropical Agriculturist* that scions of *Cinchona Ledgeriana*, grafted upon the stocks of the red-bark, contained less than the usual amount of quinine, but that the bark of the stock was thereby rendered richer in that product. Professor GEORGE L. GOODALE, who reports the case in *Science*, 1883, page 611, thinks that the grafts, which were four years of age, may have been too young for a reliable test.

Another example to which I can not now refer, is reported from France, where an alkaloid was transferred from scion to stock. If I remember correctly it was a case of *Solanum Dulcamara* grafted upon the potato.

DISEASE.

The transfer of disease from scion to stock, and *vice versa*, is well authenticated. McINTOSH states[1] that "the influence of the graft upon the stock appears scarcely to extend beyond the power of communicating disease, as shown by the difficulty of inducing health and vigor in a tree that has been grafted from another in an unhealthy state, even although grafted upon a healthy stock." And again:[2] "It is said that peaches wrought upon the pear-plum stock are much less liable to mildew than those upon the common muscle stock."

PHILIP MILLER, in his "*Gardener's Dictionary*" 1731, under "Malus," says that the crab tree is generally preferred to most other sorts for grafting improved varieties of apples on, it being the most durable stock "and not so liable to canker as those which are produced from kernels of better apples."

Mr. F. BURR is reported in the Transactions of the Massachusetts Horticultural Society for 1889, page 11, as having had a tree bearing a medium-size apple which perished on the tree before it was fully ripe. "To save the tree and overcome the difficulty, he grafted it with the small English Russet, which is a remarkably long keeper. The grafts grew well and bore fine Russets, but to Mr. BURR's disappointment they inherited the peculiarity and rotted so badly that they were fit only for early cider."

Dr. ERWIN F. SMITH gives abundant evidence[3] that peach yellows may be transferred to health stocks by means of budding.

The experiments of Professors BURRILL and ARTHUR, in transferring pear blight from diseased to healthy trees by inoculation, may also be mentioned in this connection.

The pear upon quince stocks blights somewhat less than when grafted on pear roots, but it is still by no means exempt from that disease. The importance, in certain cases, of securing disease-resisting stocks is illustrated by the success of French vine-growers in overcoming the Phyloxera disease by grafting upon stocks of American grapes.

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1 Book of the Garden, Vol. II, page 326.
2 *Ib.*, page 328.
3 Bulletin 9, Bot. Div. (Sec. Veg. Path.) U. S. Dept. Agriculture, 1889.

VARIEGATION.

Although variegation is unquestionably a disease, its transfer by means of grafting has attracted so much attention that it may be treated by itself. BRADLEY, as long ago as 1727, called variegation a "distemper" which may be "communicated to every plant of the same tribe by inoculating only a single bud."

The following remarks are made by F. W. BURBIDGE on this subject:[1] "Variegation can in many cases be communicated to a green-leaved plant by budding or grafting it with variegated scions from the same or allied species. In the case of abutilons this is a well-known fact, and soon after Messrs. VEITCH introduced the vermilion-flowered, green-leaved *A. Darwini*, a variegated form was artificially produced on the continent by budding it with scions from the golden blotched *A. Thompsoni.* This practice has also succeeded with the ash, sweet chestnut, laburnum, pelargonium, common chestnut, maple, jasmine, oleander and passion flower . . . . The first record that I have been able to discover of this phase of vegetative hybridism-transmission of variegation to a green-leaved stock by grafting—is in BLAIR'S "Botanik Essays" 1720, page 386; and two years afterward a Mr. FAIRCHILD observed that a green-leaved passion flower, which had been budded with a scion from a variety with golden-blotched leaves, became in part variegated."

The following appears in *The Garden*, Volume VII, 1875, page 258: "A curious fact in connection with the aucuba-leaved variety of *Passiflora quadrangularis* has been made known by Mr. LEMOINE of Nancy. Grafted upon *Abutilon Thompsoni* and *Passiflora Imperatrice Eugenie*, a scion of this plant has communicated its variegation to both stocks, but only to such shoots as have pushed out above the spot where the graft was inserted." A scion of *Tacsonia Buchanani* was inserted in the same variegated *Passiflora quadrangularis* and this graft has now commenced to take up the variegation of the stock.

GEORGE W. CAMBELL of Ohio states[2] that he grafted *Abutilon Mesopotamicum variegatum* on *Abutilon Boule de Neige* and obtained variegated shoots on the stock below the graft. MARSHALL P. WILDER stated before the Massachusetts Horticultural society that he had never succeeded in transferring variegation in abutilons by budding or grafting.

JOSIAH HOOPES in the proceedings of the American Pomological society for 1873, page 130, says: "During the past season a mountain ash, upon which was budded a variety with variegated leaves, commenced to push forth young shoots from the main body of the tree below the point where the bud was inserted. In every case these had variegated leaves."

GEORGE SYME, in the *Gardeners' Chronicle*, 1877, page 246, states that in 1000 Acer Negundos [*Negundo Aceroides,*] budded with the variety *variegatum*, twenty produced variegated shoots from the stock, some of them below, others above the insertion of the bud.

In the *Gardeners' Chronicle*, for 1871, page 1291, it is stated that in the nursery of WILLIAM PAUL at Waltham Cross a variegated variety of *Castanea vesca* was grafted, standard high, on a tree of the ordinary green-leaved form. The graft took, but afterward died, and subsequently a young shoot with well-marked variegation on its leaves broke out from near the base of the stem. The variegation was of a creamy white color

[1] The Garden, Vol. X. 1876, page 350.
[2] Report Michigan Pomological Society, 1877, page 451.

and margined similar to, but probably rather whiter than that of the variegated chestnut usually met with.

M. T. Masters states in the *Gardeners' Chronicle*, 1872, page 322, that variegated willows have been known to affect the stocks on which they are grafted.

In the *Gardeners' Chronicle* for 1887[1] is an illustrated account of a variegated *Ulmus campestris* grafted on a green-leaved stock. The graft died, but a variegated shoot arose afterward from the stock on the opposite side of the stem from where the graft was inserted.

In the following additional cases, variegation appeared in the stock after the bud of the variegated variety had died:

H. House, in *The Garden*, vol. IV, 1873, page 33, says. "Some twelve months ago my attention was directed to a tree having golden foliage, which surpassed anything of the sort I had ever seen for richness of color and effect. On examination I found it to be a horse chestnut, evidently suffering from disease, caused either by soil or situation. In July last I got some buds from it, and worked them on some young trees, at about three or four feet from the ground, a number of which have failed, but, strange to say, many of the stocks have produced foliage exactly like that of the parent of the scion, though the buds themselves are dead. I can not say whether or not the stocks in which the buds are growing are similarly affected, as it is not usual to let such stocks produce foliage, nor can I see any signs of the yellow color in the growing buds. My opinion is that many of the buds had not vitality enough to keep them alive through the winter, but that during their short period of existence they managed in some way to impart the variegation to the stock, and that in the case of the growing buds they may have been more vigorous, and by the help of the stock may have outgrown the variegation altogether. Another curious thing connected with the matter is that there is not the least trace of variegation in the foliage of any one of the stocks below the incision made at the time of budding."

George Syme says in the *Gardeners' Chronicle*, 1877, page 246: "Twenty-seven stocks of *Fraxinus excelsior* were budded with *Fraxinus Americana acubæfolia* at heights varying from two to four feet from the ground. Nearly all united readily, and looked well until the following spring, when a majority of the buds separated and fell from the pieces of bark that were inserted with them; only three pushed into growth. At present they are all growing together as they did then, but two thirds of the number are more or less completely inoculated with the coloring matter of the variety propagated, below as well as above where they are budded, and on all parts of the plants." No other change in the character of the leaves took place.

In the Philosophical Transactions (Abridgement) vol. VI, part 2, page 341, is the following, as quoted by E. L. Sturtevant (Transactions Massachusetts Horticultural society, 1880, page 99): "Henry Cane, in April, 1692, cut off a small part of the common white jessamine, not larger than a tobacco-pipe, at two joints above the ground and grafted with the yellow-striped jessamine. It took, but grew feebly, and in four or five weeks died, and part of the stock died also, and was cut off. The next year it broke out at the joint below with several shoots of the striped variety, and also made a strong shoot from the root of the striped variety.

[1] 3d. ser., vol. II, pages 284, 369.

He tried the same experiment with several other variegated plants, but did not find any of them to transmute as the jessamine did." Other cases of variegation induced in the jessamine by budding are quoted by Dr. STURTEVANT in the above-mentioned article.

M. T. MASTERS, in the *Gardeners' Chronicle*, 1872, page 322, gives several examples of variegated scions communicating their variegated character to the stock. In one case a variegated abutilon was extensively propagated by being grafted on other stocks, and Mr. MASTERS saw whole series of such plants in which the stock had acquired variegation from the scion. He further remarks that Mr. VAN HOUTTE, a well-known nurseryman of Ghent, had ascertained that if by some accident the graft were separated from the stock the leaves subsequently produced from the latter were wholly green, and even the variegated leaves already produced lost their mottled character.

In the *American Journal of Horticulture* for 1871, page 215, mention is made of a green-leaved abutilon growing in the Cambridge botanic garden, which sent out a variegated branch after having been grafted with the variegated *Abutilon Thompsoni*. The graft was then cut off, but this branch continued to bear variegated leaves.

A case of the transfer of variegation from stock to graft is given in the *American Journal of Horticulture* for 1871, page 185. It consists of an account taken from the *Gardeners' Magazine*, of two green-leaved varieties of abutilon which became variegated when grafted upon the vatiegated *Abutilon Thompsoni*.

Two additional cases may be given where variegation, transferred from scion to stock, produced new varieties which remained permanent. The first is that of Mr. BROWN of England,[1] who mentions a yellow ash, grafted on a common ash, which induced the latter to put forth blotched leaves, thus forming a new variety which had been propagated for fifty years as the Bredalbane ash. The next case was presented by M. LEMOINE to the Central Horticultural society of France, and reported in *The Garden* 1884, page 200. The variegated *Passiflora quadrangularis* inarched on both *Passiflora Raddiana* and *Passiflora Imperatrice Eugenie* induced in both the latter species, above the point of union, variegated branchlets which were propagated as new varieties. Conversely, a scion of *Plassiflora vitifolia* grafted on a stock of the variegated *Passiflora quadrangularis* produced variegated leaves.

LINDLEY mentions[2] "certain kinds of variegated roses which retain their gay markings when budded, but become plain on their own bottom."

HARDINESS.

T. A. KNIGHT states as follows, in his "Horticultural Papers," page 223: "Many gardeners entertain an opinion that the stock communicates a portion of its own power to bear cold without injury to the species or variety of fruit which is grafted upon it, but I have ample reason to believe that this opinion is wholly erroneous and this kind of hardiness in the root alone can never be a quality of any value in a stock, for the branches of every species of tree are much more easily destroyed by frost than its roots."

A. S. FULLER says in the *Horticulturist*, volume XXIII, 1868, page 74:

[1] Quoted by Darwin in Animals and Plants under Domestication, Vol. 1, page 478.
[2] Theory of Horticulture, 1852, page 221.

"The hardiness of a tree is but slightly changed by the stock except as its growth is influenced to mature early or late in the season."

C. M. HOVEY, in the Transactions of the Massachusetts Horticultural Society, 1880, page 104, said: "If trees could be made hardier by grafting on hardy stocks, that would be a very important point; but the idea of acclimation by this means is utopian."

PHILIP MILLER of England, in his "Gardener's Dictionary," 1731, in the article on grafting, says, on the other hand: "It is by this method that many kinds of exotic trees are not only propagated, but also rendered hardy enough to endure the cold of our climate in the open air; for, being grafted upon stocks of the same sort which are hardy, the grafts are rendered more capable to endure the cold, as hath been experienced in most of our valuable fruits now in England which were formerly transplanted either from more southerly climates and were at first too impatient of our cold to succeed well abroad, but have been by budding or grafting upon more hardy trees rendered capable of resisting our severest cold."

J. C. LOUDON, in the *Horticulturist* (1849), page 283, says: "The hardiness of some species is also increased by grafting them, as in the case of *Eriobotyra Japonica* on the common thorn, and the *Pistacia vera* on the *Pistacia Terebinthus.* The *Quercus virens* is rendered hardier by being grafted on the evergreen oak; but in other cases the species are rendered more tender, as when the lilac is grafted on the phillyrea. Those species that are rendered hardier by grafting have probably tender roots, and by being placed on such as are hardier they suffer only from the cold at top, instead of being injured by the effects of cold both at root and top; or if they grow more stunted they will also be less susceptible of cold."

The editor of the *Revue Horticole* states in that journal for 1880, page 402, that in a collection of several thousand sorts of rose nearly every plant was winter-killed, both stock and graft, with the exception of three hardy varieties, which were uninjured either as stock or graft, thus showing that hardy grafts maintain vitality in the stock.

The peach, in the cool climate of England, is more successful on the plum than on its own roots.[1]

B. A. MATTHEWS of Knoxville, Iowa, states in the Report of the Iowa Horticultural Society for 1886, page 101, that the peach on plum stocks does better with him than on peach stocks. It seems to ripen earlier and stand the winters better.

J. SIBLEY of England says in *The Garden*, Vol. XXV, 1884, page 62: "I had in the severe winter of 1871 a sad experience. All the pear trees in my garden grafted on quinces were killed by the hard frost, while those on pear stocks survived." A similar experience in France is quoted in the *Gardeners' Monthly* for 1883, page 173.

A. J. DOWNING, in his "Fruits and Fruit Trees of America" (1869), page 29, says: "A variety of fruit which is found rather tender for a certain climate or a peculiar neighborhood is frequently acclimatized by grafting it on a native stock of very hardy habits. Thus, near the sea coast, where the finer plums thrive badly, we have seen them greatly improved by being worked on the beach plum."

W. J. BEAL, in the Report of the Michigan Board of Agriculture for 1876, page 204, says: "I have tried to find out whether the Baldwin apple would not be more hardy in cold climates if top-grafted upon a hardy tree. I believe it is so affected, at least in some cases."

1 Lindley, quoted by M. T. Masters in Encyclopædia Britannica, 9th edition, Vol. XII, page 213.

J. L. Budd is quoted in the Transactions of the Massachusetts Horticultural Society for 1880, page 98, as saying: "We find that varieties like Jonathan and Dominie will do well on very hardy early-maturing stocks like Gros Pomier and Duchess, though they fail when root-grafted."

In the Reports of the Iowa Horticultural Society, particularly the Report for 1885, are various papers and discussions on the question whether hardiness can be gained by the use of hardy stocks, in which the general opinion is that there is such a gain thereby.

N. K. Fluke, for example, states in the Report of this society, for 1888, p. 234, that in his experience some tender varieties are rendered more hardy by being grafted upon hardy stocks.

In the cases thus far given the hardiness induced by grafting has appeared to be the direct result of naturally hardy stocks, or in some cases, as in the peach on the plum, to be the result of a more moderate growth and early ripening. In the following instances, on the other hand, greater hardiness has accompanied *increased* vigor as the result of grafting.

J. J. Thomas, in the report of the United States Patent Office (Agriculture), 1856, page 315, said: "Trees are also made hardier by being grafted on hardier stocks, as the peach and apricot on the plum and the half-tender species of magnolia (*Magnolia conspicua* and *soulangina*) at the north are made to endure the winters there by working them on the wild and hardy cucumber magnolia" [*M. acuminata*].

L. Wetherell, in the transactions of the Massachusetts Horticultural Society, 1879, page 23, said: "A scion of *Magnolia glauca* inserted in *Magnolia acuminata* will grow to three times its natural size and be more hardy."

C. M. Hovey, in the same publication for 1880, page 115, admits the increase in size of various other magnolias when grafted on *Magnolia acuminata*, but denies that there is any gain in hardiness thereby.

J. G. Jack, in *Garden and Forest*, 1890, page 54, states that the dwarf *Quercus Georgiana* upon its own roots grew more slowly and was less hardy, than when grafted on *Quercus Robur*. The stocks in this case increased in diameter more rapidly than the grafts. *Fraxinus anomala*, a southwestern species, also grew more rapidly and was more hardy when grafted upon *Fraxinus Americana* than when grown as seedlings. The observations were upon young trees in the Arnold Arboretum at Cambridge, Massachusetts.

The editor of *The Gardeners' Chronicle*, 1879, page 596, quotes some observations of Mr. Barron, at Chiswick, which showed that the French Paradise apple when *ungrafted* was shorter lived than when grafted with other more vigorous varieties.

As a rule, in this country, trees more often fail from lack of hardiness in the top than in the root, and generally the trunk is more likely to be injured, both by winter cold and summer heat, than the larger limbs. If more hardy trunks can be secured, therefore, some tender varieties may be grown where otherwise they could not. Top-grafting has been used to some extent for this purpose and offers many advantages in this direction. One drawback to this method lies in the fact that in the west, where hardiness is most needed, top-grafted trees are less certain to be healthy than at the east, the grafts not always uniting quite as well there as in the more moist and uniform climate of the Atlantic states.

The value of top-grafting, however, for the west, can not be denied. H. W. Lathrop of Iowa City, Iowa, says, in the report of the Iowa Horti-

cultural Society for 1885, page 147: "Where some varieties are subject to bark-bursting or sun-scalding, more than others, these difficulties may be avoided by top-grafting them on more hardy stocks, but tender varieties are not made hardy by this process."

J. L. BUDD of Iowa says in *Garden and Forest* 1890, page 79: "There is no proof that a tree which is liable to injury in our trying climate can be made hardier by grafting it on an iron-clad stock, but top-working is of advantage in more than one way. In our interior climate, trees doing well under forest conditions as to shade of stem may utterly fail when the stems are exposed to the direct rays of the sun and hot southwest winds when isolated on the open prairie. As an instance, the Buffalo-berry (*Shepherdia argentea*) is plentiful on the banks of the upper Missouri, growing thickly like hazel brush; but when planted by itself in our yards with a stem three feet in height, it is certain to be dead on the south side of the stem in three years. But top worked on the Asiatic species (*Elæagnus angustifolia*) even at a height of six feet, its stem will remain perfect. Of this we have examples in many directions. In fruits some varieties fail in stem which are perfect in top. In such cases top-working on stocks that are proof against sun and wind is an evident advantage."

ADAPTATION TO SOIL.

It is known that trees which are not adapted to certain soils may in some cases be made to grow in them by being grafted on stocks which are adapted to such soils. M. T. MASTERS, editor of the *Gardeners' Chronicle*, says:[1] "From a careful series of experiments made in the Horticultural society's garden at Chiswick, it was found that where the soil is loamy, or light and slightly enriched with decayed vegetable matter, the apple succeeds best on the Doucin stock, and the pear on the quince; and where it is chalky it is preferable to graft the apple on the crab, and the pear on the wild pear. For the plum, on loamy soils, the plum; and on chalky and light spils, the almond, are the most desirable stocks; and for the cherry, on loamy or light rich soils, the wild cherry, and on chalk the Mahaleb stock."

In the preceding section it was shown that for cold climates the plum is useful as a stock for the peach. This is true particularly in cold, damp soils. T. A. KNIGHT of England said:[2] "Our gardeners suppose the plum stock to be under all circumstances the best for the peach. On the other hand, for very light soils, the peach forms a valuable stock for the plum. JOSIAH HOOPES says:[3] "The junction of certain varieties of the plum on peach roots is perfect, and for light soils better results may be obtained than with plums on their own roots."

For the almond the plum stock is preferred for cold and wet soils to those of the peach or the almond itself, being much hardier than they.[4]

C. M. HOVEY says that *Magnolia glauca*, being a bog plant, is grafted in ordinary cultivation on *Magnolia acuminata*.[5]

M. SAHUT states * that certain species of pine which require a sandy soil may be made to grow on calcareous soils by grafting them upon the Austrian or other species adapted to such soils.

1 Encyclopedia Britannica, 9th edition, vol. XII, page 213.
2 Transactions London Horticultural Society, vol. II, 1812, page 19.
3 Proceedings American Pomological Society, 1873, page 131.
4 McIntosh's Book of the Garden, vol. II, page 328.
5 Transactions Massachusetts Horticultural Society, 1880, page 115.
* Revue Horticole, 1885, p. 398.

A. J. DOWNING, in his "Fruits and Fruit Trees of America" (1869), page 29, says that in the region where the Beach plum (*Prunus maritima*) grows, the cultivated plums do better grafted upon that species than upon their own roots. The same author says: "M. FLOSS, a Prussian gardener, succeeded in growing fine pears in very sandy soils where it was nearly impossible to raise them before by grafting them on the mountain ash, a nearly related tree which thrives on the driest, lightest soil."

MCINTOSH states[1] that: "When the soil is damp and subject to be overflowed occasionally with water, such as meadows by river-sides, etc., the quince will be found the best stock for the pear; whereas, in dry soils it would be the very worst. Again, the white beam-tree is the best stock for pear in chalky soils; in such soils even the pear stock would scarcely live." A French writer adds[2] that the hawthorn grows on calcareous soil too dry for the pear or quince, and that on such a soil it forms a better stock for the pear than either of these.

J. L. BUDD of Iowa, says: [3] "The Gros Pomier apple does remarkably well on sandy land where many sorts utterly fail. Working the sorts that fail on sand on this stock seems to meet with success. "Again, the Tetofsky does well on low, wet prairie land where most other sorts fail, and experience has shown an advantage in using it as a stock on such soils."

Although it is clear that plants may be made to grow on unfavorable soils by being grafted on others which are adapted to such soils, there is some evidence that the graft alters the conditions of nutrition of the stock, not only so as to affect its vigor of growth and duration of life as already shown, but also so as to make it more exacting as to the soil required. An unknown writer states that although the peach does comparatively well on the black plum, yet on certain soils where the plum is the only fruit tree that succeeds it also fails when the peach is grafted upon it.

M. SAHUT of France states[4] that the grafting of the cultivated varieties of pear on the common quince renders the roots of the quince more particular as to the nature of the soil. They then require a soil which is unusually cool and fertile, while when not grafted, or when grafted on the Portugal quince, the common quince is longer lived and remains a long time in a good condition even in a soil which is much less fertile and cool.

SPLIT GRAFTS.

The history of the changes produced by grafting would be incomplete without some account of the alleged production of graft-hybrids by the union of the halves of two different scions. The case of the apple known as Sweet-and-Sour, said to have been produced in this manner, has already been noticed.

C. G. PRINGLE of Vermont says:[5] "Occasionally there springs from the point of junction of the scion with the stock a branch whose leaves, flowers, and fruit are intermediate in character between those of the two; and sometimes skillful gardeners unite sections of different tubers or bulbs, or even branches, and see them blend together in growth and produce mottled flowers or fruits."

1 Fruits and Fruit Trees of America (1869), page 29.
2 Book of the Garden, vol. II, page 325.
3 Revue Horticole, 1886, p. 553.
4 Garden and Forest, 1890, page 79.
5 Country Gentleman, 1670, p. 182.

The following quotations are taken from Darwin on this subject:[1] "Gärtner quotes two separate accounts of branches of dark and white-fruited vines which had been united in various ways, such as being split longitudinally, and then joined, etc.; and these branches produced distinct bunches of grapes of the two colors, and other bunches of grapes either striped, or of an intermediate and new tint. Even the leaves in one case were variegated." . . . "I should not have quoted the following case had not the author of 'Des Jacinths' (Amsterdam, 1769, page 124) impressed me with the belief, not only of his extensive knowledge, but of his truthfulness: he says that bulbs of blue and red hyacinths may be cut in two, and that they will grow together and throw up a united stem (and this I have myself seen), with flowers of two colors on the opposite sides. But the remarkable point is, that flowers are sometimes produced with the two colors blended together, which makes the case closely analogous with that of the blended colors of the grapes on the united vine-branches." "Mr. R. Frail stated in 1867, before the Botanical society of Edinburgh (and has since given me fuller information), that several years ago he cut about sixty blue and white potatoes into halves through the eyes or buds and then carefully joined them, destroying at the same time the other eyes. Some of these united tubers produced white and others blue tubers; and it is probable that in these cases the one half alone of the bud grew. Some, however, produced tubers partly white and partly blue; and the tubers from about four or five were regularly mottled with the two colors. In these latter cases we may conclude that a stem had been formed by the union of the bisected bulbs; and as tubers are produced by the enlargement of subterranean branches arising from the main stem, their mottled color apparently afforded clear evidence of the intimate commingling of the two varieties." "I have repeated these experiments," says Darwin, "on the potato and on the hyacinth, on a large scale, but with no success."

In the *Gardeners' Chronicle* for 1882, vol. XVII, page 636, it is stated that a new variety of sugar cane had been produced in Brazil by graft-hybridization, two pieces of cane, cut lengthwise, having been joined together. The editor, M. T. Masters, regards the case as doubtful, and states that no good evidence exists that grafting of any kind is possible in monocotyledons. Woodrow, in his "Gardening in India," page 61, makes the same statement.

F. W. Burbidge states[1] that black, white, and red or striped grapes have been produced on the same bunch by splicing the brances of a black-berried and a white-berried vine together, and analogous effects have been produced by grafting the tubers of red and white potatoes.

S. Folsom says in the *Country Gentleman*, 1873, page 582: "I united a sweet scion with a sour—both large and delicious apples—and so grafted the two on a Fall Pippin tree that they united in a single branch. The sweet graft was a red apple; the sour as near white as any apple you will see, and the Pippin is a green-colored fruit. My cross, which fruited in 1871, and again in 1872, has distinct portions of sour and distinct portions of sweet in the same apple, and is green in color. Beyond this it bears no resemblance to either of the fruits from which it was produced. Small, knurly, bitter, it is the most undesirable apple I ever tasted."

In the *Gardeners' Chronicle* for 1874, page 121, occurs the following: "Mr. Chaffee of Attica, New York, says his neighbor, Asa Jones, was in the reputed habit of uniting the grafts of a sweet and a sour apple so as

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[1] Animals and Plants under Domestication, vol. I, pp. 474-475.

to cause two half-buds, one of each sort, to unite into one sprout. Mr. CHAFFEE has tasted sweet-and-sour apples from trees said to be thus produced. The apples were Rhode Island Greening on one side and some sweet variety on the other. A number of trees are mentioned that bear these sweet-and-sour specimens. Five years ago Mr. CHAFFEE grafted a number of trees in this way, out of which three united, the united scions sending up a single vigorous shoot. One of these has fruited, and has borne apples half sweet and half sour, but unlike either of the two sorts united to form the new graft." The editor adds: the old sweet-and-sour apple (the sour part resembling the Rhode Island Greening), is a peculiar variety, well known more than fifty years ago. It is a belief with some that it was produced by united buds, but this belief has never been established.

THOMAS MEEHAN of Pennsylvania communicated the following in a paper on "Graft Hybrids," at a meeting of the American Association for the Advancement of Science, in 1876:[2] "During the past few years it has been asserted that new varieties of potato have originated in this way: A tuber is taken, and all the eyes cut out; a wedge with an eye of another kind is then inserted into the eyeless mass and planted. The results are said to be true hybrids. Many of our best physiologists doubt this. I have not seen these cases; but I must say that the evidence afforded is much stronger than much of that on which some popular theories have been built. I tried the split and grafting process, not believing it would result in hybridity. I merely wished to test the popular notion. I am pleased to be able to say now that it is correct. New varieties can be obtained in that way. I took the Rhode Island Greening and the Red Astrachan—two very distinct varieties of apple in every respect. The grafts, with a single bud, were split as near through the center as possible, and a piece of each kind fitted together so as to appear one complete scion. Twelve of these were grafted; three grew; two of these have fruited; neither are Rhode Island Greening, and the two are unlike each other. One of these has a flower like the Rhode Island Greening; and the flower of Red Astrachan is rosy and in many ways distinct from the large white one of the Rhode Island Greening; but the fruit is, in many respects, similar to that of the Red Astrachan. The second variety has the flower similar to that of the Rhode Island Greening, and the fruit somewhat the color of the Red Astrachan, ripening about the same time, but is but half the size, very much flattened, and with a slender stem near two inches long, and as much like that of a Siberian Crab as can be. There is no doubt but two varieties distinct from the parents, and distinct from each other, have resulted from this graft process." In the same journal, for 1881, page 90, it is stated that one of these graft hybrids still remained, bearing fruit like Red Astrachan and flowers like Greening.

In 1876 the *Gardeners' Monthly* (page 308), published an account of a sour-and-sweet apple tree said to have been produced by "inculcating a young tree with a half of two buds taken respectively from sweet and sour apple trees and firmly joined together before inoculation."

THOMAS MEEHAN, the editor, adds: "We know now that buds can be united, and the result is the blending of characters, forming a new individual kind—a true hybrid—but the experiments so far made do not favor the idea that two distinct characters can be made to run along separately in one tree."

1 The Garden, vol. X, 1876, p. 350.
2 Proceedings A. A. A. S., 1876, p. 254; Gardeners' Monthly, 1876, p. 306.

Five years later[1] Mr. MEEHAN is reported as saying that after regrafting his "graft hybrids" on bearing trees, the only difference between them and other Red Astrachans was that the flowers were pink instead of white. The fruit did not vary more than in common grafting.

The case of the so-called trifacial orange, said to have been produced by artificially splitting and uniting the seeds taken from three distinct varieties, is referred to elsewhere. Probably no amount of testimony would convince a botanist that such a result was possible.

In the *Gardeners' Chronicle* for 1871, page 341, a lemon is mentioned in which two of the cells or "quarters" are filled with sweet juice, while the remainder contained acid juice as usual. There is no testimony in this case as to there having been any grafting or cross-fertilization. Many such cases are attributed to "graft hybridization," but in this instance no such cause was claimed.

GRAFTING POTATOES.

A favorite experiment with some is the grafting together of portions of potato tubers of different varieties in the attempt to produce "graft hybrids." Mention of such experiments has been made in preceding sections. The usual method is to cut out the eyes from a tuber of one variety and insert in their places eyes taken from a tuber of a different variety. It is believed by many that by this means tubers will be formed partaking of the character of both varieties. It is said "on very good authority,"[2] that several of the best varieties grown in England were produced in this way.

In the *Gardeners' Chronicle*, for 1882 (vol. XVIII, p. 560), is an account of the production of a new variety of potato by Herr Reuter of Germany, by grafting. Grafts from tubers of the White Mexican were inserted into tubers of Black Kidney. From eight tubers so treated he obtained two "hybrid" specimens which have since been propagated, and which are intermediate in form and color between the above named varieties. In the same connection is quoted an observation of Herr Rimpau in which he says: "I have myself taken a stock of a white color and grafted on it an eye of a red variety, and among the produce of the two potatoes I found several pure representatives of the variety from which the scion was taken, a few of the stock variety, and in addition I found five tubers which I consider as intermediate between the stock and the hybrid (scion?) with regard to color."

In the *Gardeners' Chronicle* for 1886, vol. XXV, p. 54, W. G. Smith gives the result of planting 48 plug-grafted potatoes of several varieties, for the purpose of determining whether intermediate forms could be obtained by that method. In every case the tubers produced were of unusual form, in some of the cases intermediate between the varieties grafted. In the same volume, page 180, this writer, after describing and figuring his plug-grafted potatoes, says: "The produce may not be a hybrid character. I never implicitly believe in anything."

In the same journal, for 1873, page 1015, it is stated that dwarfing of the haulm was the general result of grafting together the tubers of two varieties of the potato.

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1 Country Gentleman, 1881, p. 310.
2 The Garden, vol. VIII, 1875. p. 318.

In the *Revue Horticole* for 1890, page 531, it is stated that Edward Leport of France has demonstrated that in potatoes the stock influences the graft in quality, nature of the flesh, color, and earliness. His method of operation is not given.

A writer in the *Country Gentleman* for 1870, page 326, states that he grafted together two varieties of the potato, the old Pheasant-eye Kidney and a red variety, leaving one eye on each piece when joined together. The produce contained some red and some Pheasant-eye tubers, and two or three tubers which were striped from the eyes. These latter he at first believed to be graft-hybrids, but finding afterward some tubers having the same appearance among a crop of the Pheasant-eye, he regarded them only as sports.

R. Munro, an English gardener, states in *The Garden*, (vol. XII, page 522), that he grafted a large number of distinct kinds of potato in the usual manner, but in no instance was any case of "hybridism" obtained. It is safe to say that it is not now believed by the best informed botanists and horticulturists that new varieties of potato can be produced at will by grafting the tubers.

GRAFT HYBRIDS.

I now come to consider the nature and permanence of the changes produced by grafting. Are these modifications of a truly hybrid character, or are they, like the changes brought about by different soils and climates, the results of altered nutrition?

G. J. Romanes, in the article on hybridity, in the Encyclopedia Britannica [1] says: "It is well known that when two varieties or allied species are grafted together, each retains its distinctive character. But to this general, if not universal, rule there are on record several alleged exceptions, in which either the scion is said to have partaken of the qualities of the stock, the stock of the scion, or each to have affected the other. Supposing any of these influences to have been exerted, the resulting product would deserve to be called a graft-hybrid. It is clearly a matter of great interest to ascertain whether such formation of hybrids by grafting is really possible; for, if even one instance of such formation could be unequivocally proved, it would show that sexual and asexual reproduction are essentially identical. The cases of alleged graft-hybridism are exceedingly few considering the enormous number of grafts that have been made every year by horticulturists, and have been made for centuries. Of these cases the most celebrated are those of Adam's laburnum (*Cytisus Adami*) and the Bizzarria orange. . . . The other instances of alleged graft-hybridism are too numerous to be here noticed in detail; they refer to jessamine, ash, hazel, vine, hyacinth, potato, beet, and rose. Of these the cases of the vine, beet, and rose are the strongest as evidence of graft-hybridzation, from the fact that some of them were produced as the result of careful experiments made by very competent experimentalists. On the whole, the result of some of these experiments, although so few in number, must be regarded as making out a strong case in favor of the possibility of graft-hybridism.

Burbidge, in his "Propagation of Plants," page 60, says: "We have evidence which goes a long way toward proving that it is possible to

[1] 9th edition, 1881, vol. XII, page 426.

obtain hybrid blants by grafting. *Cytisus purpurascens* is said to have been originated by M. ADAM, a Parisian horticulturist, in 1828, and was produced by grafting *Cytisus purpureus* on the common yellow laburnum (*Cytisus laburnum*) as a stock. The branches below the graft produced common yellow laburnum flowers of large size, while those above the graft bear small purple laburnum flowers, as well as reddish ones intermediate between those of the scion and stock in size and color, and not unfrequently yellow and purple flowers are borne side by side in the same cluster."

PETER HENDERSON, in 1881, stated[1] that a variegated scion would infect the stock, but that true graft hybrids never occurred.

In 1879, WILLIAM BURNS of Scotland exhibited before the Scottish Horticultural association, three specimens of pear, the Aston Town, Beurre Clairgeau, and a fruit from a graft of the latter set in a tree of the former. The Aston Town is small and nearly spherical, the Clairgeau more than twice as large, and, as is well known, much elongated, while the fruit borne by the Clairgeau graft upon the tree of Aston Town was intermediate in size and shape between the others. Figures of these fruits are given in the *Gardeners' Chronicle* for 1880, page 53. The number produced was not stated.

In the same journal for 1880, page 597, the editor, M. T. MASTERS, states that he has now received flowers and shoots of the supposed graft-hybrid and finds them intermediate in character between that of the stock and scion. He therefore, "in spite of the prevailing scepticism among gardeners as to this point," is inclined to regard the case as one of true graft-hybridism.

THOMAS MEEHAN, in the *Gardeners' Monthly*, May, 1867,[2] gave an account of a pear on the mountain ash, in which he says: "It is a well-attested fact that seven inches below the junction of the two a pear shoot appeared upon the mountain ash stock." Such a case would indeed need to be well attested before botanists and horticulturists would be likely to accept it.

Do graft-changed varieties retain their newly acquired features? M. T. MASTERS (*Gardeners' Chronicle*, 1883, page 667) thinks it probable that they do; and gives the permanence of the so-called graft-hybrid, *Cytisus Adami*, as an example. Another writer in the same journal (1883, p. 729) believes that graft-changed varieties will revert, when grafted on other stocks, to the usual form, and states that he has repeatedly seen evidence of the fact. An instance is given where the grape, Golden Queen, grafted on Buckland Sweetwater, became long and pointed and improved in quality, the changes being so great that the variety became unrecognizable. Cuttings taken from this graft, however, again produced the Golden Queen of the original character.

In the section on "Variegation" it was shown that variegation induced by budding or grafting was sometimes permanent and sometimes not.

G. J. ROMANES states in the article in the Encylopedia Brittanica already referred to[3] that Adam's laburnum is now flourishing in numerous places throughout Europe, all the trees having been raised as cuttings from the original graft, which was made by inserting a bud of the purple laburnum into a stock of the yellow. M. ADAM, who made the graft, has left

[1] Country Gentleman, 1881, page 760.

[2] Quoted in American Agriculturist, 1868, page 260, and apparently referred to in Gardeners' Chronicle, 1872, page 322.

[3] 9th edition, 1881, vol. XII, p. 426.

on record that from it there sprang the existing hybrid. There can be no question as to the truly hybrid character of the latter—all the peculiarities of both parents being often blended in the same raceme, flower, or even petal; but, until the experiment shall have been successfully repeated, there must always remain a strong suspicion that, notwithstanding the assertion, and doubtless the belief, of M. Adam, the hybrid arose as a cross in the ordinary way of seminal reproduction.

Similarly the Bizzarria orange, which is unquestionably a hybrid between the bitter orange and the citron—since it presents the remarkable spectacle of these two different fruits blended into one—is stated by the gardener who first succeeded in producing it to have arisen as a graft-hybrid; but here again a similar doubt, similarly due to the need of corroboration, attaches to the statement. And the same remark applies to the still more wonderful case of the so-called trifacial orange, which blends three distinct kinds of fruit into one, and which is said to have been produced by artificially splitting and uniting the seeds taken from the three distinct species, the fruits of which now occur blended in the triple hybrid."

To this may be added the following on "bifacial oranges" from the *Tropical Agriculturist*, 1884, page 712: In the "*Province Agricole*, M. Heckel tells us how the fruits which on one side present the characteristics of oranges and on the other those of lemons are produced. A nurseryman at Cannes, M. Tordo, takes scions (*burgeous*) of various species of citrus, orange, lemon, etc., and grafts them circularly around the trunk of a citrus, arranging the scions closely together in pairs, so as to bring about complete fusion of scions. When the grafts have adhered, the trees are headed down to within a short distance of the grafts, and in spring branches are seen which give rise to monstrous fruits having the different characteristics of the different grafts blended together. The branches which originate from the ingrafted shoots produce leaves which are greatly changed in form and differ from those of either species, thus affording a striking proof of graft-hybridzation. The flowers of the two species are also fused."

John B. Morse is reported as follows in the Transactions of the Massachusetts Horticultural Society for 1879, page 20: "A man in Hubbardston claimed to have originated the Hubbardston Nonsuch by grafting a sweet apple on a sour. The speaker had visited the original Hubbardston Nonsuch tree, and found the top broken off, and sprouts producing fine apples, but there was no indication of grafting. The statement referred to was not merely an error, but a deliberate falsehood circulated through the newspapers." In the same publication for 1888, page 110–15, is an account of an apple known as Red Russett, which is claimed by some, without good evidence, to be a graft hybrid between the Roxbury Russett and the Baldwin. J. A. Warder says that it is supposed to be a sport from the Baldwin. (Transactions Illinois Horticultural Society, 1870, p. 62.).

In the *Gardeners' Chronicle* for 1879, pages 631 and 690, is recorded an apparent case of graft hybridization. A briar rose was grafted with a white variety, and this again with a pink variety. The last scion produced a branch which bore a white rose of a new type which was perpetuated under the name Mabel Morrison. The gardener who performed the work believed it to be a case of graft-hybridization, but Mr. Bennet, the grower, considered it a sport.

It appears, therefore, that a majority at least of the striking examples

of so-called graft-hybrids which have proved permanent are either cases of variegation, or of varieties which there is reason to believe are the result of bud variation or other causes aside from grafting. It now remains to consider whether any of the lesser variations attributed to grafting are permanent. We know that changes induced by soil and climate are often more or less permanent in their nature.

It may be well, first, to recall the theory of THOMAS ANDREW KNIGHT that all plants propagated by grafting, or division of the original plant in any way, tend to degenerate. This theory was stoutly denied by LINDLEY and others, but is still held by many to be at least probable.[1]

To obviate any injurious effect of inferior stocks, DOWNING recommends[2] in accordance with VAN MONS' theory, that seeds for the production of new varieties be taken only from ungrafted trees, though he admits that good varieties have originated from grafted fruit. Mr. ARNOLD of Michigan also believes that in making crosses the natural stock, in apples and pears. which have been grafted, may exert a bad influence.[3]

In his "Fruits and Fruit Trees of America," first edition, 1845, page 5, DOWNING says: "Among the great number of seedling fruits produced in the United States, there is found occasionally a variety, perhaps a plum or a peach, which will nearly always reproduce itself from seed. From some fortunate circumstance in its origin, unknown to us, this sort, in becoming improved still retains strongly this habit of the natural or wild form, and its seeds produce the same. We can call to mind several examples of this; fine fruit trees whose seeds have established the reputation in the neighborhood of fidelity to the sort. But when a graft is taken from one of these trees and placed upon another stock this grafted tree is found to lose its singular power of producing the same by seed, and becomes like all other worked trees. The stock exercises some, as yet unexplained, power in dissolving the strong natural habit of the variety, and it becomes, like its fellows, subject to the laws of its artificial life."

In the edition of 1869, the author says that this doctrine has "perhaps no foundation in fact," and has been neither established nor disproved by experiment; and adds, "observation of many years leads to the belief that the mere engrafting of a variety upon another stock in no way affects its habit or capacity for reproducing itself."

DARWIN gives grafting as one of the causes which may induce variability in plants. He says[4] "CABANIS (quoted by SAGERT, "Pomological Physiology," 1830, page 43) asserts that when certain pears are grafted on the quince their seeds yield more varieties than do the seeds of the same variety of pear when grafted on the wild pear."

And again[5] he quotes the statement of M. CARDANMALLE, made in 1848: "The Lalande variety of the walnut tree leafs between April 20 and May 15, and its seedlings invariably inherit the same habit; while several other varieties of the walnut leaf in June. Now, if seedlings are raised from the May-leafing Lalande variety, grafted on another May-leafing variety, though both stock and graft have the same early habit of leafing, yet the seedlings leaf at various times, even as late as the fifteenth of June."

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1 See, for example, Asa Gray, American Journal of Science, vol. XXXVI, 1863, p. 434.
2 Fruits and Fruit Trees of America (1869), p. 7.
3 W. J. Beal, Report Michigan Board of Agriculture, 1876, p. 214.
4 Animals and Plants under Domestication, vol. II, page 312.
5 Ib., page 313.

QUANTITY OF STOCK.

Does the size or amount of the stock affect the extent of its influence upon the graft?

. A writer quoted in the *Tropical Agriculturist* (1884, p. 634), believes that vigorous stocks have little influence on the vigor of the graft (except at first) unless some of the top of the stock is left, and conversely that dwarfing stocks have little permanent effect in increasing fruitfulness.

E. A. Carriere states (*Revue Horticole*, 1883, page 390) that the increased vigor imparted to a pear by double working on a vigorous variety which has been grafted on the quince, is still maintained when the intermediate graft is no more than two to four centimeters (about an inch) in length.

J. A. Warder says in his "American Pomology" (1867), page 86: "There is a theory held by some orchardists that the further the junction of the graft with the stock is removed from the root, the better will be the fruit. This, however, is not well supported, and the circumstance when observed is probably dependent upon other causes."

Charles Downing said:[1] "There is no doubt that in large trees top-grafted, the stock has more or less influence, but when grafted or budded on small stocks near the ground the influence, if any, would be little."

F. K. Phœnix of Illinois, in an article in the *Western Rural* for 1887, p. 212, on top-grafting choice apples on crab stocks to securd hardiness, says that as the crab is the smaller tree it dwarfs the graft and its fruit; and "the more of the crab body and branch below the graft, the more dwarfish would we expect the growth of the graft and fruit to be."

F. W. Burbidge says:[2] "Mr. Pearson of Chilwell, after having experimented with grape vines grafted on different stocks, came to the conclusion that the stock, if completely headed off and not allowed to make any leaf growth of its own, lost all influence on the scion in about four years."

D. T. Fish says:[3] "Changes, if any, so affected would possibly be gradual; the tendency to change, if any, would also be greatly influenced by the extent of stock left, and probably also by such a fact as whether any of the stocks were allowed to grow or not. With established habits as to time of flowering, it is not likely that these would be suddenly changed at the bidding of a dwarf stock a few inches in length, though some features more in harmony with the nature of the stock might be gradually acquired. Facts are very much wanted on this curious phase of vegetable life."

Again, Burbidge says:[4] "Do we not rob the stock of a deal of its power to ameliorate the scion when we denude it of all its own leaves?"

A. S. Fuller says in the *Horticulturist*, vol. XXIII, 1868, p. 76: "A few years since I had an opportunity of witnessing a singular effect of leaves on growth. An old Easter Beurré pear had been allowed to over-bear and consequently had become very much enfeebled in growth, so much so that it did not make an inch of growth upon any one of its branches. One of the small branches was cut off and a scion from a Vicar of Winkfield placed upon it. The graft made a growth of two feet the

1 Transactions Massachusetts Horticultural Society, 1880, page 118.
2 The Garden, vol. X. 1876, page 350.
3 The Garden, vol. XX, 1881, page 591.
4 Propagation of Plants, page 63.

first season; the next season the graft not only continued its rapid growth, but the entire tree appeared to revive and send out new and vigorous shoots. My theory in this case may not be a correct one, but I believe that the cause of this change in the old tree was owing to the demand which the new graft made upon the roots for plant food; they, in turn, received materials for their extension. The supply which was gathered and sent forward, not being all absorbed by the graft, was forced into the old branches, increasing the size of their leaves, thereby causing a reaction in the entire tree."

A writer in the Transactions of the Massachusetts Horticultural Society for 1879, page 18, said: "When part of a large tree is cut off and grafted, the scions receive from the remaining limbs, through the cambium layer, elaborated sap which overcomes the scion, but this is impossible when the whole top of a little tree is cut off and grafted."

W. M. PAUL of England, in the *Gardeners' Chronicle*, 1873, page 681, says: "Where plants are united and both allowed to grow even out of the same stem there is a change. I know an example of a camellia united in that way, a *Saccoi nova* inarched into a large, semi-double. The first named variety opened its centre every year, and bore the color of the latter, and was consequently of less value till after it [the latter] was headed down, when the good variety toek on its natural form. The leaves [of the stock] in this case must have had the power of altering the character of the flowers" [of the graft].

CONCLUSION.

In the foregoing pages there is abundant evidence that the stock and graft influence each other's growth in many ways. Seldom, however, is it shown that the recorded observations were based on direct experiments undertaken for the particular purpose of determining the modifying influence of the stock or graft. Certain of the statements made are contradictory; and if we would come to any conclusion in the matter, some of the testimony must be rejected. In at least a few cases the changes said to have been observed were evidently imaginary or due to other causes than grafting. As these cases appear to form but a small proportion of the whole, and as it is of some interest to know what beliefs are held, I have not excluded testimony simply because it seemed unreasonable to me. There is need of careful and extended experiments to fully settle many of the points involved, and the writer hopes to contribute something to this end in the future. A careful study of existing evidence seems to justify the following conclusions:

1. *Size and vigor.*—The stock and graft each imparts to the other something of its own degree of vigor or lack of vigor. This influence is greater the first year or two than afterward. If the difference in vigor is great, both stock and graft may ultimately perish. The dwarfing which in certain cases results from grafting does not always arise from a diminished supply of food, but often indirectly from earlier and more abundant fruitfulness.

2. *Form.*—The alterations in the forms of trees, as the result of grafting, arise mainly from increased or diminished vigor. This probably applies also to alterations in the form of the roots, vigorous roots having larger, longer, and fewer branches than feeble ones. Many of the observed changes, however, in the form of the roots of grafted trees, are

probably due to the trees having rooted from the graft. The observed changes in the form of the fruit of the graft, causing it to resemble that of the stock, are as yet too few to be considered other than accidental.

3. *Fruitfulness.*—The most important of all the results of grafting is increased fruitfulness. This is brought about (*a*) by the mere process of grafting, which operates in the same manner as a ligature, or the removal of a ring of bark; (*b*) by diminished vigor through defective nourishment from a feebler stock; (*c*) by increased vigor imparted by vigorous stocks to varieties which are naturally too feeble to bear heavily.

4. *Precocity.*—Earlier, as well as more abundant, fruiting is induced by the act of grafting; also by diminished vigor due to dwarf or feeble stocks. The precocity of trees on dwarf stocks is not, however, always directly due to diminished vigor, but largely to the habit of early bearing imparted to the graft by the stock in a manner not fully understood. Probably the diminished supply of sap derived from dwarf or feeble stocks, and its consequent richer character, is an important factor in inducing the earlier and more abundant fruitfulness.

5. *Season of growth and maturity.*—The stock and the graft each modifies the period of vegetation of the other when their normal times of beginning or closing their season's growth are different. Thus, a late variety grafted upon an early stock begins and ends its season's growth earlier than it otherwise would. This alteration in habit appears in some cases to affect the time of ripening of the fruit.

6. *Hardiness.*—There is some evidence that hardy stocks increase the hardiness of the grafts. This, however, does not appear to be by the transfer of any inherent hardiness peculiar to the variety, but to result from the increased or diminished vigor in certain cases or an earlier maturity in varieties which, upon their own roots, are inclined to grow too late in the season. The advantage usually sought in hardy stocks is to furnish hardy stems able to resist injury to the bark by sun-scald, etc., and to supply roots of uniform hardiness in place of those of ordinary seedlings which are frequently less hardy than those of most cultivated varieties. Conversely, a hardy graft has been known to increase the hardiness of the stock, but known examples of this are rare, and usually no such influence can be observed.

7. *Adaptation to soil.*—"Favored by the influence of the stock, many species are able to thrive in unfavorable soils, and often in those in which they could not live if upon their own roots." There is in this fact no evidence that the character of either stock or graft is modified. In some cases, however, the demands of a vigorous or fruitful graft may render the roots of the stock more exacting as to soil, so that they require one which is more fertile or of more definite character in which to maintain in health the grafted tree than would be required for a tree of the same kind as the stock growing in its natural state.

8. *Color.*—An alteration in color, as the result of grafting, may occur (*a*), by the direct transfer of coloring matter, as in the example of the white and yellow carrots; (*b*), by earlier or later maturity, earlier maturity inducing more heightened color; (*c*), by the restoration of normal nutrition to a "variegated" stock or scion; (*d*), by the transfer to a healthy stock of the disease known as variegation. There is little evidence that the characteristic color of fruits is modified by grafting.

9. *Flavor.*—The testimony is abundant that fruits may acquire the flavor of the fruit of the stocks on which they are grafted; this has been

especially noticed in the case of sour apples grafted upon sweet varieties. Other modification in the flavor and texture of the fruit have been noticed, which do not cause them to resemble the fruits of the stock. The operation of grafting itself often causes the fruit to be larger and more succulent, and to ripen earlier; this latter change, when it causes more perfect ripening, improves the flavor. We can say that certain stocks improve the flavor of fruit borne by the graft, while others deteriorate it, and that it is probable that stocks bearing highly flavored fruits intensify the flavor of the fruit borne by the graft, while stocks bearing fruits which are sweet or mild in quality diminish it; but notwithstanding the abundant testimony to this end, direct and careful experiments are needed.

10. *Disease.*—The evidence is conclusive that certain diseases may be conveyed from stock to graft, and *vice versa.* This applies not only to diseases caused by parasitic fungi, but also to the peculiar form of malnutrition known as variegation. It will be observed that nearly all the best established changes which are noted are due to altered nutrition, and though they sometimes cause the stock and graft each to acquire some of the features of the other, these alterations extend mainly to such points as vigor, color, and period of vegetation, and in no case can they be considered to be of the nature of hybridism.

IS GRAFTAGE A DEVITALIZING PROCESS?

BY DR. L. H. BAILEY.

Mr. CROZIER's monograph was just in type when there appeared, in *Farm and Home* of Wilmington, Delaware, a paper by Prof. L. H. BAILEY of Cornell university, under the above title, read before a recent meeting of the Peninsula Horticultural society of Dover. It is regarded as an answer to Mr. BURBIDGE, who holds that graftage is necessarily injurious and is here given as germane to Mr. CROZIER'S paper as well as being of interest and practical value.—*Secretary.*

To the popular mind there seems to be something mysterious in the process of graftage. People look upon it as something akin to magic and entirely opposed to the laws of nature. It is popularly thought to represent the extreme power which man exercises over natural forces. It is strange that this opinion should prevail in these times, for the operation itself is very simple and the process of union is nothing more than the healing of a wound. It is in no way more mysterious than the rooting of cuttings, and it is not so unnatural, if by this expression we refer to the relative frequency of the occurrence of the phenomena in nature. Natural grafts are by no means rare among forest trees, and occasionally the union is so complete that the foster stock entirely supports and nourishes the other. Cuttings, however, are very rare among wild plants; in fact I know of but one instance in which cuttings are made entirely without the aid of man, and that is the case of certain brittle willows whose branchlets are

easily cast by wind and snow into streams and moist places, where they sometimes take root. But mere unnaturalness of any operation has no importance in discussion of phenomena attaching to cultivated plants, for all cultivation is itself unnatural in this ordinary sense.

But I further fail to see why the union of scion and stock is any more mysterious or unusual than the rooting of cuttings; in fact it has always seemed to me to be the simpler and more normal process of the two. A wounded surface heals over as a matter of protection to the plant, and when two wounded surfaces of consanguineous plants are closely applied, nothing is more natural than that the nascent cells should interlock and unite. In other words, I do not see why two cells from different allied stems should refuse to unite any more than two cells from the same stem. But why bits of stem should throw out roots from their lower portion and leaves from their upper portion, when both ends may be to every human sense exactly alike, is indeed a mystery. We regard healing as one of the necessary functions of stems, but rooting can not be so regarded.

I have said this much by way of preface in order to free your minds of any feeling which you may possess that graftage is in principle and essence opposed to nature, and is therefore fundamentally wrong. A large part of the discussion of the philosophy of grafting appears to have been random because of a conviction or assumption that it is necessarily opposed to natural processes.

It does not follow from these propositions, however, that graftage is a desirable method of multiplying plants, but that the subject must be approached by means of direct and positive evidence. Much has been said during the last three years concerning the merits of graftage, and the opponents of the system have made the most sweeping statements of its perniciousness. This recent discussion started from an editorial which appeared in *The Field*, an English journal, and which was copied in *The Garden* of January 26, 1889, with an invitation for discussion of the subject. The article opens as follows: "We doubt if there is a greater nuisance in the whole practice of gardening than the art of grafting. It is very clever, it is very interesting, but it will be no great loss if it is abolished altogether. It is for the convenience of the nurserymen that it is done in nine cases out of ten, and in nearly all instances it is not only needless but harmful. . . . If we made the nurserymen give us things on their own roots, they would find some quick means of doing so." A most profuse discussion followed for a period of two years, in which many excellent observers took part. Some of the denunciations of graftage are as follows: "Grafting is always a makeshift, and very often a fraud." "Grafting is in effect a kind of adulteration. . . . It is an analogue of the coffee and chicory business. Grafted plants of all kinds are open to all sorts of accidents and disaster and very often the soil or the climate or the cultivator is blamed by employers for evils which thus originated in the nursery. . . . If in certain cases grafting as a convenience has to be resorted to, then let it be root-grafting, a system that eventually affords the scion a chance of rooting on its own account in a natural way." "Toy games, such as grafting and budding, will have to be abandoned, and real work must be begun on some sound and sensible plan." "Any fruit-bearing or ornamental tree that will not succeed on its own roots had better go to the rubbish fire at once. We want no coddled or grafted stuff when own-rooted things are in all ways infinitely better, healthier, and longer lived." These sweeping statements are made by F. W. BURBIDGE of Dublin, a well-known

author, whose opinions command attention. The editor of *The Garden* writes: "We should not plant any grafted tree or shrub so far as what are called ornamental trees and shrubs are concerned. There may be reason for the universal grafting of fruit trees, though we doubt it." I have not cited these quotations in any controversial spirit, but simply to show the positiveness with which the practice of graftage is assailed. And as the presumption is in favor of any practice which has become universal, these statements possess extraordinary interest.

The reasons advanced for these denunciations of graftage, are three, so far as I can learn; and as these are essentially the reasons which have already been cited by the opponents of the system, we will consider them here. These are, 1, the citation of numerous instances in which graftage (by which I mean both grafting and budding) has given pernicious results; 2, the affirmation that the process is unnatural; 3, the statement that own-rooted plants are better—that is, longer lived, earlier, more virile than graft-rooted plants.

1. The citations of the injurious effects of graftage are usually confined to ornamental plants, and the commonly cited fault of the operation is the tendency of the stocks to sucker and choke the graft. This fault is certainly very common, but on the other hand there are numerous instances in which it does not occur, for instance, in peach, apple, pear and many other fruit-trees, and in very many ornamentals. In fact, it is of no more common occurrence, in the plants which have fallen under my observation, than is the pernicious suckering of plants grown from cuttings, as in the lilacs, cutting-grown or sucker-grown plums, and many other plants, in which suckers must be assiduously kept down or they will choke the main stem which we are endeavoring to rear. And these remarks will apply with equal force to every citation which I have ever seen of the ill-effects of graftage: the cases simply show that the operation has been a failure or is open to objections in the particular instances cited, and afford no proof that there may not be other plants upon which graftage is an entire success. For myself, I am convinced that graftage has been indiscriminately employed, and it is apparent to everyone that there have been many failures. But this does not prove graftage wrong, any more than the wrong practice of physicians prove that the science of medicine is pernicious. If there are plants upon which graftage is entirely successful, then all must agree that the operation itself, *per se*, is not wrong, however many cases there may be to which it is not adapted.

2. The proposition that graftage is unnatural and therefore pernicious is no more or less than a fallacy. In the first place, there is nothing to show that it is any more unnatural than the making of cuttings, and if naturalness is proved by frequency of occurrence in nature, then graftage must be considered the more natural process of the two, as I have already shown. One of the more determined writers upon this subject has said that "it is quite fair to say that raising a tree from seed, or a shrub by pulling it in pieces (cuttings) is a more natural mode of increase than by grafting." I can not understand by what token the author is to prove that pulling a plant in pieces is more natural than graftage; and there has been no attempt, so far as I know, to show that it is so.

But the whole discussion of the mere naturalness of any operation is really aside from the question, for every operation in the garden is in some sense unnatural, whether it be transplantation, pruning, or tillage. And it is well known that these very unnatural processes may sometimes

increase the longevity and virility of the plant. Plants which are given an abundance of food and are protected from insects and fungi and the struggle with other plants, are better equipped than those left entirely to nature. It is the commonest notion that cultivation is essentially an artificial stimulus, that it excites the plant to performances really beyond its own power, and therefore devitalizes it. But this is a fallacy. All plants and animals in a state of nature possess more power than they are able to express, and they are held in a state of equilibrium, as Mr. Spencer puts it, by the adaption of environment. Once the pressure of existing environment is removed, the plant springs into the breach and takes on some new features of size, robustness, or prolificacy, or distributes itself in new directions. The whole series of benefits which arise from a change of seed is a familiar proof of this fact. So that, if cultivation, domestication, or in other words, unnaturalness, may be sometimes a stimulus, it is not necessarily so. Cultivation differs from natural conditions more in degree than in kind. Or, as Darwin writes, "Man may be said to have been trying an experiment on a gigantic scale; and it is an experiment which nature during the long lapse of time has necessarily tried."

3. It is said that own-rooted plants are better than foster-rooted. This is merely an assumption, and yet it has been held with dogmatic positiveness by many writers. If mere unnaturalness, that is, rarity or lack of occurrence in nature, is no proof of perniciousness, as I have tried to show, then this statement admits of argument just as much as any other proposition. And surely at this day we should test such statements by direct evidence rather than by *a priori* convictions. And here I will repeat that the citation of any number of instances of the ill effects of graftage is no proof that own-rooted plants are necessarily better, if there should still remain cases in which no injurious effects follow. Now, if it is true that "own-rooted things are in all ways infinitely better, healthier and longer lived" than foster-rooted plants, and if "grafted plants of all kinds are open to all sorts of accidents and disaster," then the proposition must admit of most abundant proof. I will analyze the subject by discussing the following questions: *a.* Is the union always imperfect? *b.* Are grafted plants less virile than own-rooted ones? Are they shorter lived?

a. It is well known that the physical union between scion and stalk is often imperfect and remains a point of weakness throughout the life of a plant. But this is not always true.

There are scores of plants which make perfect physical unions with other plants of their own species, or even with other species, and it follows that these, alone, are the plants that should be grafted. The very best proof which can be adduced that the union may be physically perfect, is to be found in the micro-photograph of an apple graft published two years ago in the *American Garden* by my former associate, Professor C. S. Crandall.* The cells are knit together so completely that it is impossible to determine the exact line of union. I have in my possession a number of the micro-photographs, taken by Mr. Crandall, which show the same condition.† Mr. Crandall also figures, on the same page, a microscopic section of an apple graft in which the union is very poor, but this graft was made in a different manner from the other; and that is another proof that the operation should be suited to the subject.

* American Garden, XI, 65.
† These were exhibited at the Convention.

These were grafts made upon nursery stock, and it would appear that if the union were good at the expiration of the first year, it would remain good throughout the life of the plant. In order to test this point I procured two apple trees fifteen years old and over six inches in diameter which had been grafted at the surface of the ground in the nursery. In the presence of two critical observers, I split the trunks into many pieces, but no mark whatever could be found of the old union. The grain was perfectly straight and bright through the crown. I am the more willing to cite this case because I had fully expected to find a decayed or dead portion or a contorted grain at the point of union; but every internal evidence of a graft had disappeared.

So far as the strength of a good union is concerned, all fruitgrowers know that trees rarely break where they are grafted. There is an old seedling orchard upon my father's farm into which many grafts have been set. I have myself set many hundreds of these grafts in the tops of the trees, often far out on large limbs; and in the immediate neighborhood I have set many thousands under similar conditions; and yet with all the breaking of the trees by ice, storms, and loads of fruit, I have never known a well-established union to break away. And I have had the same experience with cherries and pears. I have lately tested the strength of the union in a different way. A few days ago I cut two "stubs" from an old and rather weak apple tree which had been cleft-grafted in the spring of 1889. These stubs were sawed up into cross-sections less than an inch thick, and each section, therefore, had a portion of foreign wood grown into either side of it. These sections were now placed on a furnace and kept very hot for two days in order to determine how they would check in seasoning, for it is evident that the checks occur in the weakest points. But in no case was there a check in the amalgamated tissue, showing that it was really an element of physical strength to the plant. A similar test was made with yearling mulberry grafts and with similar results; and this case is particularly interesting because there were three species ungrafted, —the common Russian mulberry, *Morus rubra*, and *M. Japonica*.

From all these considerations it is evident that, admitting that hundreds of poor unions occur, there is no necessary reason why a graft should be a point of physical weakness, and that the statement that "grafted plants of all kinds are open to all sorts of accidents and disaster," is not true.

b. Are grafted plants less virile,—that is, less strong, vigorous, hardy, shorter lived than others? It is evident that a poor union or an uncongenial stock will make the resulting plant weak, and this is a further proof that indiscriminate graftage is to be discouraged. But these facts do not affirm my question. There are two ways of approaching the general question,—by philosophical consideration and by direct evidence.

It is held by many persons than any asexual propagation is in the end devitalizing, since the legitimate method of propagation is by means of seeds. And this notion appears to have found confirmation in the conclusions of Darwin and his followers, that the ultimate function of sex is to revitalize and strengthen the offspring of the union of the characters or powers of two parents; for if the expensive sexual propagation invigorates the type, asexual propagation would seem to weaken it. It does not follow, however, that because sexual reproduction is good, asexual increase is bad, but rather that the one is, as a rule, better than the other, without saying that the other is injurious. We are not surprised to find, therefore, that some plants have been asexually propagated for centuries with apparently no decrease of vitality, although this fact does not prove

that the plant may not have positively increased in virility if sexual propagation had been employed. The presumption is always in favor of sexual reproduction, a point which, I suppose, will be admitted by everyone. And right here is where graftage has an enormous theoretical advantage over cuttage or any other asexual multiplication: the root of the graft springs from sexual reproduction, for it is a seedling, and if the union is physically perfect—as I have shown is frequently the case—there is reason to suppose that grafting between consanguineous plants is better than propagating by cuttings or layers. In other words, graftage is really sexual multiplication, and if seeds have any advantage over buds in forming the foundation of a plant, graftage is a more perfect method than any other artificial practice. It is, in fact, the nearest approach to direct sexual reproduction, and when seeds can not be relied upon wholly, as they can not, for the reproduction of many garden varieties, is the best ideal practice, always provided, of course, that it is properly done between congenial subjects. It is not to be expected that the practice is adapted to all plants, any more than is the making of cuttings of leaves or of stems, but this fact can not be held to invalidate the system.

It has been said in evidence that graftage is a devitalizing or at least disturbing process, that grafted plants lose the power of independent propagation. Mr. Burbidge writes that "any plant once grafted becomes exceedingly difficult of increase, except by grafting." I have never known a case in which this is true. We are now forcing wood from both budded and cutting-grown roses, and cuttings grow equally well from both. All our fruits grow just as readily from seeds from grafted as from seedling trees, and I have never heard of a well-authenticated case of a plant which grows readily from cuttings becoming any more difficult to root after having been grafted.

But is there direct evidence to show that "grafting is always a makeshift," that it is a "toy game," that "grafted plants of all kinds are open to all sorts of accidents and disaster," that "own-rooted things are in all ways infinitely better, healthier, and longer-lived?" These statements allow of no exceptions; they are universal and iron-bound. If the question were to be fully met, we should need to discuss the whole art of graftage in all its detail, but if we can find one well-authenticated case in which a grafted plant is as strong, as hardy, as vigorous, as productive and as long-lived as seedlings or as cutting-plants, we shall have established the fact that the operation is not necessarily pernicious, and shall have created the presumption that other cases must exist.

Some forty years ago, my father took apple seeds from his old home in Vermont and planted them in Michigan. Upon my earliest recollection the resulting orchard was composed of some hundred or more lusty trees, but as most of the fruit was poor or indifferent, it was decided to top-graft the trees. This grafting was done in the most desultory manner, some trees being grafted piece-meal, with some of the original branches allowed to remain permanently, while others were entirely changed, over at once; and a few of them had been grafted on the trunk, about three or four feet high, when they were as large as broomsticks, the whole top having been cut off when the operation was performed. A few trees which chanced to bear tolerable fruit, scattered here and there through the orchard, were not grafted. The orchard has been, therefore, an excellent experiment in grafting. Many of the trees in this old orchard have died from unde-

terminable causes, and it is an interesting fact that fully half, and I think even more, of the deaths have been seedling trees which were for many years just as vigorous in every way as the grafted trees; and of the trees that remain, the grafted specimens are in every way as vigorous, hardy, and productive as the others. And some of these trees have two tops, one of which was grafted shoulder-high in the early days, and the other being grafted into the resulting top many years later. And those trees which contain both original branches and grafted ones in the same top, show similar results,—the foreign branches are in every way as vigorous, virile, and productive as the others, and they are proving to be just as long-lived. Here, then, is a positive experiment compassed by the lifetime of one man—for my father is still living—which shows that own-rooted trees are not always "infinitely better, healthier and longer-lived than grafted plants." And furthermore, cases like this are by no means rare, nor are they confined to fruit trees. In the case of peaches, I have had a similar experience. The first orchard upon my father's place was composed entirely of seedlings, yet the trees were no longer-lived than budded trees, and they were attacked just as seriously by yellows. And in this connection I will cite the fact that the old seedling orchards which still remain to us about the country are much more uneven, contain more dead trees or vacant places, than the commercial orchards of even the same age. This is due, as I have pointed out, upon another occasion,* to the struggle for existence in the old orchards by which the weak trees have disappeared, while the grafted orchards, being made up of selected varieties of known virility and hardiness, have remained more nearly intact, and if the seedling orchards have suffered more than the grafted ones, it must be because they have had more weak spots.

I contend, also, that the universal favor in which graftage is held in America is a strong presumption in its favor. We differ among ourselves as to the best methods of performing the operation, but I have never heard an intelligent American condemn the system as necessarily bad or wrong. In 1890 there were growing in the United States nurseries 240,570,666 apple trees, 88,494,367 plum trees, 77,223,402 pear trees, and 49,887,874 peach trees, with enough other species to make the total of fruit trees 518,016,612. All of this vast number will go as grafted or budded trees to the consumer and he will accept none other. It is true that half of them may die before they reach bearing age, from various causes, but graftage itself plays a small part in the failures, as may be seen in the case of grapes and small fruits which outnumber the tree fruits in nursery stock and of which less than one half, probably, reach maturity, and yet these are all cutting-grown plants. It is in nineteen cases out of twenty the carelessness of the grower which brings failure.

I have drawn my arguments and illustrations from fruit-trees because I have had a more extended familiarity with them, and it has been my desire to determine if graftage is, of itself, necessarily pernicious, rather than to discover its merits in specific cases. I am sure that others can corrobate my conclusions from various ornamental plants, and I could myself cite many instances.

It is impossible, if one considers the facts broadly and candidly, to arrive at any other conclusion than this: Graftage is not suited to all plants, but in those to which it is adapted—and they are many—it is not a devitalizing process.

* On the Longevity of Apple Trees, before Kansas Horticultural society, 1890.

DISEASES OF TREES LIKELY TO FOLLOW MECHANICAL INJURIES.

[Read before the Massachusetts Horticultural Society, March 7, 1891. Issued in December, 1891.]

Ladies and Gentlemen—On several occasions you have listened to addresses on the subject of diseases of plants and the nature of blight, mildew, rust, and smut, and the habits of the fungi which cause them must now be more or less familiar to you all. I, therefore, shall not attempt, today, to speak in detail of any of the diseases just mentioned, but I am glad that I have been able to accept your invitation to address you at this particular time, because there is another subject of great importance, as it seems to me, especially for the people of Massachusetts, on which there is widespread ignorance and general indifference. If I can succeed, even to a small extent, in diminishing popular ignorance of the matter to be discussed here, it is to be hoped that the present indifference will gradually disappear, for, as has been the case hitherto, the members of this society can be trusted to do missionary work in arousing the public to a sense of what should be done to remove existing evils.

So far as the diseases of fruit trees and garden plants are concerned, the public have their eyes open and they require little urging to lead them to seek proper means for checking the growth of the fungus-parasites which affect the pocket by injuring the crops, or diminish our æsthetic enjoyment by disfiguring our gardens and greenhouses. But with regard to our shade trees and forest trees there is general indifference and, although what I have to say may appear to be more appropriate for a forestry association than a horticultural society, I have confidence that my hearers will allow me to use the word horticulture in a large sense, and will recognize that this community looks to them as the authorized promoters of all that tends to the welfare, not only of fruits and flowers, but also of our shade trees, which, if well cared for, are both beautiful and useful.

It is a mistaken notion that shade trees do not need care and protection. Nevertheless most persons believe that, unless a tree is to bear marketable fruit, it can be left to take care of itself. Those who live in the remoter country districts might, perhaps, be pardoned for holding this belief; but those of us who live in thickly settled towns ought to know by this time that the life of shade trees, exposed as they are to the unfavorable or even injurious conditions of the soil and atmosphere of manufacturing districts, is a precarious one. We have all seen the older trees killed off, and know that with each succeeding generation the younger trees are inferior to the older, for those which escape the injurious action of the soil and air are too often injured by the wilful violence of men.

Theoretically, if one is asked what the trees in our streets are good for, he would say, to serve as shade in summer and to beautify the town at all

seasons. Practically, however, many people believe that the great use of the trees is to serve as supports for telegraph wires, as ladders for telephone workmen, or as convenient places for fastening horses. In short, that a tree should be so treated that it may develop a symmetrical form and luxuriant foliage is nobody's business, while, on the other hand, it is assumed that it is the right of every one to fasten his horse to any tree he pleases or to use the branches as supports for wires. The march of improvement, as it is called, never respects the trees. If a sidewalk is to be widened, down go the trees, or their roots are chopped off in such a way as to injure them. If some enterprising man wishes to build a new house on the site of an old one, the old house is sold for a song and is moved off to some distant part of the town, being dragged along through narrow streets crushing and maining the trees on the way, just as if these public ornaments were of no account compared with private gain. In fact, it sometimes seems as if a good many people believed that one could not do anything to a tree which really would injure it, and that a tree is so constituted that it can grow on in spite of all obstacles.

We should begin by recognizing that a tree is a living thing which is not only readily affected by the soil and atmosphere, but is also sensitive to mechanical injuries to a degree which might not at first be suspected. An animal tells us by its actions when it has been injured. We know the injuries done to trees only by the after effects, which may not be evident for months or even a few years, and it is my special purpose today to call your attention to some of the injurious effects which follow mechanical injuries. The subject is rather complicated and implies some knowledge of the microscopic structure of trunks and branches, but I shall endeavor to avoid technicalities as far as possible.

Before we can understand the harm done by mechanical injuries we must first consider briefly the normal structure of the trunk. If we examine with a microscope a cross-section of a very young twig, we find that the surface is composed of a single layer of thin, colorless cells called the epidermis, beneath which are several layers of larger cells, many of which contain green coloring matter. Then come the vascular bundles arranged in a ring, although they are not really in contact with one another but are separated by what we may call the rays, which pass from the pith to the outer green cells, and are composed of cells not unlike the latter in shape, that is spherical or polyhedral, or some simple modification of these forms. A longitudinal section through the vascular bundles shows that the cells of which they are composed are, in great part, very much elongated, so that they may be called fibres, ducts, or vessels. When seen in cross-section, each vascular bundle is wedge-shape and, if carefully examined, is found to consist of an outer and an inner part; that is, in respect to the circumference of the tree. The inner portion develops into the hard wood of the stem, while the outer part becomes a portion of what, for want of a better expression, we may call the inner bark, or blast. Between the outer and inner parts of the vascular bundle is a thin layer of small, colorless, brick-shaped cells, the cambium. The cambium is the most important part of the stem, since its cells during the season of growth are constantly forming new wood cells on the inner side, while those on the outer side are forming new cells of the inner bark. The cambium itself does not vary much in thickness at different ages and, extending continuously throughout the length of the stem, forms the circumference of a cylinder whose diameter increases from year to year. It is important to bear in mind that it is

essentially the cambium which is the growing formative, part of the stem, whereas the wood cells formed constantly on its inner side soon cease to grow and, although their walls become thick and hard, the cell contents disappear, so that the cells of the hard wood are practically dead and unable to produce new cells. They form a series of hard tubes very important in the economy of the plant, by giving strength and rigidity and serving as means of passage to liquids and gases.

We must consider especially the action of the epidermis and the cambium. As has been said, the colorless epidermal cells differ from the cells beneath them in being thinner and flatter. The latter include the chemically active cells which in the younger parts of plants transform the food elements into special substances of use to the plant.

The epidermal cells, on the other hand, form merely a thin, protective membrane. They serve in the first place to check evaporation and, furthermore, their outer wall is usually transformed into a cuticle which is nearly impervious to water and is unaffected by a good many substances which would injure the walls of ordinary cells. An important property for us to consider in this connection is their ability to resist the growth of the mycelium of many fungi, which, when the epidermis is removed, are able to make their way to the more delicate and succulent cells beneath, a point to which I shall refer later.

As the cambium constantly increases in circumference and the new wood and inner bark increase correspondingly in bulk, it is plain that the epidermis, unless endowed with the power of increasing in circumference, must soon be ruptured, thus exposing the more delicate cells beneath. The epidermis does not possess this power except to a very limited extent, but to avoid the danger which must follow an exposure of the sub-epidermal cells to the air after the rupture of the epidermis, which must inevitably take place early in the life of a plant, nature makes provision for the transformation of the sub-epidermal cells into a zone of cork cells, which act as a protective sheath after the epidermis proper is ruptured. The way in which cork cells are formed is seen on a small scale when a potato tuber is cut in halves. The wounded cells shrivel and die, but the more or less spherical cells beneath become divided into a series of thinner, flatter cells by the formation of new cell walls parallel to the cut surface, and the walls themselves become tough and resistant. The epidermis of the stems and branches in reality remains intact but a short time, usually only one year, and then is ruptured and soon disappears; but, meanwhile, the sub-epidermal cells, having been changed into a series of cork cells like those mentioned in the cut potato but on a larger scale, form a new proctective covering which replaces the epidermis. Furthermore, the new cork layer itself is only to a moderate extent capable of extension, and as the inner parts of the stem continue to increase it is in turn ruptured, and the breaks are closed by the formation of a second layer of cork cells beneath. This process is repeated indefinitely, so that in stems several years old, we have what is in popular language called the bark, composed of several different layers of cork cells more and more split up and cracked externally.

If we now recognize the structure of the normal stem or trunk in its essential points, we can next consider the primary effects of wounds. In the first place, whenever a trunk or branch is wounded, no matter whether by the action of wind or snow, by the bites of animals, by pruning, or by wilful violence of man, nature itself attempts to heal the wound if possible. If the wound is not too great, it heals by natural processes, but

many wounds are so large or so severe that even in the course of several years nature can not close them. In such wounds disease is likely to arise, which will infect the whole tree, unless man comes to the aid of nature. Let us then consider the question of the manner in which nature acts and to what extent. The two natural protective processes when trunks and branches are wounded are the formation of cork cells and the formation of a callus. The two processes may go on together. If the wound is slight, as when the outer bark is scraped or gnawed off, so as to expose the more delicate cells beneath, a new formation of cork may be sufficient to close the wound. But when, as is very frequently the case, both the outer and inner bark are torn away, exposing the wood, or when a good-size branch is cut off or broken off, the healing process is quite different. You have frequently seen the scars left when branches have been cut away and know that the edges of the wound swell and form a thick, rounded rim which in course of time seems to contract around the wound, and, if the wound is of moderate size, finally covers it. This thickened rim is what is called the callus, and it originates mainly in the cambium which was exposed when the wound was made, and to some extent in the adjacent cells of the inner bark.

To understand what takes place it will be best for us to suppose a simple case of wounding, such as that of a branch six inches in diameter, let us say, which has been carefully sawn across so as not to loosen the attachment of the bark to the wood. The greater part of the exposed surface here would consist of the wood proper with a comparatively narrow circle of the course outer bark and the more delicate inner bark. Between the wood and the bark is, of course, the cambium, represented by the circumference of a circle quite imsignificant in thickness compared either with the bark or the wood.

Of the exposed parts the wood itself is practically unable to take any active part in the process of healing. It presents a series of open tubes, which are incapable of producing new cells. The cells of the cambium and, to a less extent, those of the inner bark and of the rays which lie near the cambium, are able to produce new cells, and hence, in the case we have chosen as an illustration, there would arise a ring of new growth just around the wood and beneath the bark. This raised ring of new growth is the beginning of the callus.

It is a well-known fact that where the cambium is exposed in wounds, it produces new cells more vigorously than the cambium of uninjured stems. The reason for this, at first sight, anomalous state of things will be easily understood if we call to mind the tension of any normal trunk. A trunk may be regarded as a cylinder composed of a solid axis of wood whose circumference is formed of the actively growing cambium encircled by the inner and outer bark, which taken together we may now, for convenience sake, call the cortex. The different parts of this compound cylinder grow under different tensions. On the one hand, the inner parts, as they grow, exert a strong outward pressure on the cortex, while, on the other hand, the cortex acts as a sheath which exerts a strong pressure on the parts within. That when the normal pressure is interfered with, the relative growth of the different parts of the stem is changed, is well shown if a slit is made through the cortex to the region of the cambium. The cells of the cambium thus freed from pressure from without grow more rapidly than before in the direction of the slit, so that the wound thus made is rapidly filled by the new cells thus formed, and the new growth may even

be so great as to more than fill the gap, and cause a slight protuberance on the wounded side. Furthermore, when the tension of the cambium is relieved by the removal of the cortex, its function of producing new wood cells on its inner side is altered, and microscopic examination of the new wood formed in wounds shows that the wood cells are shorter, and the vessels decidedly less numerous than in normal wood.

The description which I have given of the way in which the callus arises, although you may perhaps think it somewhat complicated for a popular lecture like the present, is, in reality, a brief attempt to sketch the process in its main points only, omitting many details which are of interest to specialists. What I have described is the normal mode in which the healing process begins, and is to be seen in those seasons of the year when the cambium cells are active. During the colder months of the year, however, the cambium is in a dormant condition, and if wounds occur at such seasons, the cambium is not able to form a callus at once, and the process just described does not begin until the season of plant growth returns. Meanwhile the exposed parts will probably have been more or less affected by weathering, and the closing of the wound by natural processes is made more difficult. In the case of large wounds the callus continues to increase and overlap more and more the old exposed wood, but its activity diminishes from year to year. As soon as the callus ring has begun to form, its outer cells undergo the cork-transformation, and thus the delicate cambium cells are soon covered with a protective bark similar to the normal bark of the stem, and, as this bark increases in thickness, it exerts an increasing pressure on the cambium cells beneath, which sufficiently explains why the, at first, luxuriant production of new cambium cells gradually diminishes. The function of the cambium in the normal trunk, you will recollect, is to produce new wood cells on its inner surface and new bast cells on its outer surface, and the same function is retained when it grows into a callus. We find, therefore, that in the callus itself new layers of wood are formed and overlap the old wood and, if the process goes on long enough, it happens that the old wood is entirely covered by new layers of wood and a cortex somewhat similar to that of the uninjured trunk.

So far, we have supposed that we were dealing with a wound made by cutting directly across a branch. What is true in this case is essentially true of other wounds, and we can not now stop to consider in detail the innumerable modifications depending on the form of the wound. As a matter of fact it more frequently happens, as when branches are broken by the wind or snow or by external violence of any kind, that the wound is irregular or splintered, and in such cases the cortex is often torn away from the branch below the wound and the cambium is crushed or injured. Consequently the healing process is very much hindered. Again, when trees grow thickly together, or for other reasons, the lower branches often die and break off at a certain distance from the main trunk. In such cases the stumps of the branches very often die and remain projecting as dead plugs or pegs. This is in part owing to the disturbed nutrition of the stumps, a subject too complicated to be described here. The fact is evident, however, that such pegs do not heal over but rot away, and must be considered open wounds.

Up to this point I have dwelt upon the nature of wounds and the healing process adopted by nature, and you will now ask, Why are all these elaborate changes necessary? What is the harm if a wound does not heal over? As a rule it is safe to say that the provisions of nature are

always adapted to some special end, and we should naturally infer that, since nature always does her best to heal wounds, it must be because the plant would otherwise suffer. Experience certainly shows that open wounds are dangerous in plants as they are in animals, although I would not go so far as to say that they are inevitably dangerous. There is no doubt, however, that in most cases they are dangerous. Every surgeon recognizes the dangers attending open wounds in animals, and, before the days of the antiseptic treatment, the dangerous and often fatal results of operations were due in many cases to the entrance of germs from the air into the system through open wounds. In the same way wounds of plants are dangerous, although a fatal result may not be reached before the expiration of several years. Naturally the intact epidermis of the younger parts of plants and the corky bark of the older branches and trunks prevent the access of the spores and mycelium of fungus parasites to the more sensitive tissues beneath. Where the bark has been removed, they may and often do work their way into the interior, and cause, at first, a local and, later on, a general decay of the trunk. The fungi which are the agents of destruction in such cases are not the rots, smuts, or mildews, which affect rather herbaceous plants than trees, but fungi of the toadstool family. Those of you who have watched the larger wounds of trees must have often seen clusters of toadstools of different kinds growing out of the wounds. They are most frequently seen in the warmer months, but there are a few species which are to be found even in the mild weeks which sometimes come in midwinter. Besides the fleshy toadstools there are many species of punk-fungi, belonging technically to the same family as the toadstools, which infest wounds, and they are so tough and hard that they can be found throughout the year.

The question might arise whether these toadstools and punk-fungi grow in wounds because the exposed wood is already dead and therefore furnishes food for the fungi, or whether, on the other hand, the death and decay of the wood are brought about by the presence of the fungi. In a certain sense both these questions may be answered in the affirmative. When the exposed wood dies, it furnishes a soil in which the spores of the toadstools and punk-fungi can germinate and grow, and it is also true that when they have once begun to grow, many species are able to make their way downward and upward into the healthy parts of the branches and cause them to rot. It is a very common experience that the rotting which began in a wound gradually extends to the main trunk, so that although the bark, except where the wound exists, appears to be perfectly sound, on cutting the tree down, the whole trunk is found to be rotten or hollow.

What happens, except in very small wounds which heal at once, is as follows: The porous wood takes up moisture from the air in greater or less amount according to the season, but in almost all cases enough to cause the outer exposed part to decay in the course of from a few weeks to a few months. Not only is water absorbed from rains and mists but dust and other organic substances gradually collect on the surface and there is thus formed a sort of soil, in a thin layer to be sure, but enough to support at first the growth of bacteria, which help on the decay of the solid parts, and, later, offer a favorable field for the germination of the spores of toadstools. A very small amount of damp soil is sufficient to start the growth of these toadstool-fungi. Their spores, when they germinate, give out a series of branching threads, the mycelium. The threads gain strength as they grow, and, in a good many species, they at length acquire the power

of dissolving the walls of the sound plant cells, even if they do not in the beginning possess this power. Aided by the increased moisture, which is favored by the presence of a damp, earthy layer on the surface of the wound, the destructive threads make their way slowly along the interior of the trunk, the process of destruction causing an increase of moisture and sliminess, which only makes the ultimate destruction of the hitherto sound wood the more certain. While all this is going on within the trunk there may be no definite indication on the outside of the harm done. The toadstools, as we call them, are the fructification of the fungi, of which the threads are the organs of vegetation, and it is not until after the latter have attained a somewhat advanced development that the toadstools themselves appear on the surface. Their appearance almost invariably indicates not that trouble may be expected, but that the disease has already made considerable progress.

The toadstools and punk-fungi, of which I have spoken, are usually not limited in their growth to any one species of tree, but may grow on a good many different kinds. There are some species, however, which attack only particular kinds of trees, and among the number are forms which are more virulent and rapid in their action, especially those that attack the roots when they are wounded. It is not my purpose, nor would the limited time allow me, to give an account of these special parasites. Enough, however, has been said to demonstrate the danger of open wounds and the necessity of aiding nature in her efforts to heal them. In the natural course of events many wounds must occur from the violent action of the wind and snow, and we should do what we can to remedy them. But it is perhaps more to the purpose that, recognizing the danger, we should use our influence to prevent the avoidable and wilful maiming of our shade trees by careless and ignorant people.

So far as the treatment of wounds is concerned, our object should be to cover the exposed surfaces, so that moisture, which would cause them to rot, may be excluded, and that the spores of fungus parasites may not find an entrance. A useful hint as to what should be done is given us by nature herself. In some respects the coniferous trees suffer less from wounds than other trees. The reason is that in the wood of conifers there are canals or passages which contain resinous substances, and when the wood of such trees is wounded they exude and form a close varnish of resin over the exposed surfaces, which are thus kept dry and protected from weathering. As a result, the wood is less likely to rot than in the case of other trees whose wood contains no resin. The trees of the latter description, when wounds occur by accident or design, the indication, to use a medical expression, is to coat the cut surface with tar or some similar substance. There are several practical considerations to be borne in mind in applying the tar. If the wounded surface is rough and splintered, it should in the first place be made as smooth as possible, and where branches have been broken off a few inches from the axis from which they sprung, they should be sawn off close down to the main axis.

When branches are to be pruned, it is of importance that it should be done at the right season. It might be inferred from what was said previously that the summer months would be the best time, because the cambium is then active and the callus begins to form at once. There are, however, other points to be considered. Unless the branch is small, it will take several years for the callus to cover the whole wound, and, meanwhile, the exposed wood may rot unless well coated with tar. The import-

ant question then is not so much to select the season when the cambium is most active as that when the coating can be most securely applied. During the warmer months the cut surface is kept moist because the cells are then more succulent than in late autumn and early winter, and it is not always easy to apply the tar closely under such circumstances. The pruning of deciduous trees should, when possible, be performed in the late autumn or even in early winter, rather than in summer, since the tar then adheres better. Another important point is to saw off the branches carefully, so that the cortex may not be torn away from the wood, leaving the latter projecting. This is always a more or less difficult matter, because unless the cut is made in a horizontal direction, which is seldom the case, the weight of the branch itself, during the process of sawing, tends to tear away the cortex on the lower side of the cut. Where it is possible the branch should be propped up during the cutting, and special care should be taken that there is no tearing of the cortex on the lower side. Even under favorable conditions, a pocket is apt to be formed on the lower side of the wound, and the application of tar at this point should be made with great care, since wounds are almost always vertical or oblique rather than horizontal, and rain and moisture naturally collect at the lowest point of the wound, just where the pocket is unfortunately made in cutting. It is evident that too great care can not be taken in covering this part thoroughly.

After this sketch of the nature of wounds and of the danger with which the life of trees is threatened, I trust that what I have said in regard to treatment will appear rational and practical. I must not, however, close my remarks on this subject without uttering an emphatic protest against the way in which the shade trees of our cities and towns are treated. The responsibility rests not only with those who, perhaps unintentionally and ignorantly, are directly guilty of what an enlightened public opinion should regard as vandalism; but it rests in part on ourselves, if we do not in all possible ways seek to give to the public, information, and attempt by all legal means to secure the enforcement of such regulations as shall assure proper protection for our trees. As it is, the care of the trees in our public grounds, parks, and streets is too often placed in the hands of those who are ignorant of the principles of vegetable physiology, and their efforts to prune and cut down trees are guided only by what seems to them temporary convenience, or by what commends itself to their not infrequently perverted sense of the beautiful. When the whim seizes them and they wish to get rid of a stately tree, it is only necessary for them to say that it is rotten, and dangerous because likely to fall. Many times I have seen trees whose shade could ill be spared, cut down because their trunks were rotten, when examination after they were felled, showed that they were sound and would have lasted many years. It ought to be considered a crime to cut down a handsome tree—certainly in public grounds—unless compelled by absolute necessity. When it is thought necessary for the public safety to destroy animals supposed to be suffering from contagious diseases, there is, at least, a consultation, and the opinion of experts is asked. I hope that the time will come when it will not be allowable to cut down trees which are public property, except on the advice of those whose training entitles them to be called experts.

If one is amazed sometimes at the abuses of trees on the part of those who are their authorized guardians, it must be admitted that the poor condition of our trees is principally due to the recklessness of the public.

The streets of Boston and the suburban towns are notoriously narrow, as are also the sidewalks, and in consequence the trees are more subject to injury than in regions where the streets are wider. In most of our streets the trees are very near the edge of the sidewalk, if they do not project into the street itself. Those on the corners of the streets are almost sure to be grazed by passing vehicles, and as wagon after wagon passes along, the grinding process is kept up until the wood is exposed. It is perhaps fortunate that such trees are short-lived, for they become very unsightly, and when they die, the curbstone can be replaced as often as is necessary.

Walk along any of our streets where the trees are placed on the edge of the sidewalk and notice the effects due to our general negligence. In some instances you will find that the house-owners have placed guards around the trunks, and the trees are symmetrical and have attained a good size. But in most cases, they have been left to take care of themselves. Bright and early the milkman comes along and jumps off with his can, leaving his horse to make a scanty breakfast by gnawing the bark of the nearest tree. Later on come the butcher and the grocer, whose horses lunch upon what was left by their predecessor, inflicting an amount of damage to the tree limited only by the length of time which their owners are pleased to spend in conversation with the girls in the kitchen Last of all comes, perhaps, the doctor, whose visits, if they are not frequent, are proportionally long. He, at least, ought to know that trees can not be wounded with impunity. No wonder that the bark is not only soon removed and the wood exposed, but since the horse is an animal which prefers the softer bark to the harder wood, the fresh borders of the wound are repeatedly attacked until deformities of enormous size are produced, and apart from the danger of fungus growths, the nutrition of the tree is seriously deranged. A visit to Oxford Street, Cambridge, where on one side of street the trees have not been protected, and wounds more than two feet long have been made by horses, will show that I am not exaggerating. If I mention this particular street, it is because I have to pass through it every day. Other equally bad instances might be named.

Surely there can be no excuse for such senseless and wholesale violence, especially since the remedy is so simple and so inexpensive. The trees planted along the steets are not the private property of the house-owners, with which they can do what they please. The public has the right to demand that the trees be properly guarded and protected, since otherwise it is not possible to secure the requisite shade in summer. But apart from the public rights in the matter, it is for private advantage as well that our trees should be kept in good condition, since the attractiveness of any street as a place of residence depends largely upon the beauty of the trees. Not a few of our New England towns owe their prosperity as summer resorts to the arching elms and well-rounded maples, whose loss no money could replace. It would be both just and wise for every thickly settled town and village to have laws compelling house-owners to place proper and sufficient guards round the trunks of trees growing by the roadsides, or if it be considered inexpedient to place this apparently slight burden on private individuals, it is at least the duty of municipal and town governments to provide guards and railings at the public expense. It is strange that there should be any person who lives in his own house, who would not willingly do all he can to beautify it by keeping the trees near it in the best condition. But, unfortunately, there are many such persons. Where houses are rented, the tenant is naturally little inclined to any expenditure how-

ever small, for the benefit of the landlord, and the latter is less inclined to spend money where he does not see that he is getting a direct benefit for himself. To let the trees become shabby or go to utter destruction is a short-sighted policy for any individual or community.

In short, an effort should be made to secure legislation which shall make compulsory the placing of guards around trees in exposed places. Furthermore, the care of the trees in public grounds should be entrusted only to persons especially trained for the purpose. An engineer may be admirably qualified to construct good roads, but it does not, therefore, follow that he knows how to manage trees, and even those who have attained great skill in the cultivation of flowers and the arrangement of flower-beds are not necessarily the best persons to look after trees. The desirable legislation can probably be secured just as soon as the public understand why it is desirable and necessary. It is all very well to talk about the protection of forests and the formation of national parks in distant states. But we have our own forests, which are the trees in our streets and public grounds, and before turning our eyes in other directions we had better see what is needed at home. It devolves upon you, ladies and gentlemen, so to educate the public in this matter that they shall soon learn to recognize that a tree is something to be respected and protected. It is not enough that we erect commemorative tablets before a few historical trees, and take strangers to see, not so much the trees as the tablets. Historical association may lend an additional interest, but every well-developed tree has that within itself which should command our respect and admiration, its beauty and its utility.

The lecture was illustrated by views, thrown upon a screen, of wounds caused by the gnawing of horses; specimens of skillful, and of careless pruning; stumps of broken branches, etc., showing the progress at different stages of Nature's efforts to heal them. Several kinds of fungi which are found upon and in such wounds were also shown, with the method of their growth and appearance at different stages of development. This exhibition included front, side and sectional views, which, with Professor Farlow's explanations, afforded a very clear and complete idea of the subject.

ADDITIONAL EVIDENCE ON THE COMMUNICABILITY OF PEACH YELLOWS AND PEACH ROSETTE.

PART I.—PEACH YELLOWS.

I.—INTRODUCTORY.

Destructive nature of yellows.—Peach yellows is a perplexing and destructive disease. On all hands it is conceded to be one of the most serious with which American fruitgrowers have to contend. Formerly this disease was confined to a small district on the Atlantic coast, but during the last twenty years it has invaded distant regions hitherto free, and has entirely ruined the peach industry over very considerable areas. Within ten years the disease has taken a fresh and very strong hold upon orchards in the Delaware and Chesapeake region, the north portion of the peninsula, and has destroyed thousands and thousands of trees, rendering a great industry unprofitable or precarious. It seems to be native to the eastern United States, having, so far as we know, not been reported from California. Diligent inquiry also has thus far failed to bring to light any notice of its occurrence in Europe or other parts of the globe.

The last negative evidence is from Mr. Newton B. Pierce of the division of vegetable pathology. From May to October, 1890, he was in Mediterranean countries investigating vine diseases. Mr. Pierce traveled exclusively in France, Italy, Sicily, and Algeria, and looked carefully for this disease. He examined peach trees in a great many localities, and observed the fruit in the principal markets, but failed to find any traces of yellows. Inquiries of many persons devoted to the scientific study of agriculture and horticulture also proved fruitless. They had not seen or heard of anything resembling this disease.

The distribution of the disease and the losses occasioned thereby were set forth somewhat fully in my first bulletin and do not concern us at this time. It is propor to state, however, that the losses continue in the infected districts; that the disease has appeared in new localities; and that regions now healthy are also threatened. Yellows is certainly as far south as southern Virginia and probably as far west as Arkansas and northeastern Texas. Peach-growers are earnestly advised to stamp out the disease upon its first appearance, and are warned against the importation of trees from infected districts. These remarks apply with especial force to the Pacific coast, and in this connection it is well to remember that the apricot and almond are also subject to yellows. It would be much safer for the Californians to grow their own peach trees than to introduce any from the eastern United States. If trees are imported, it should be known

beyond question that they are from regions where this disease does not occur. The mere fact that the nursery stock is healthy at the date of shipment is not a sufficient guarantee that it will continue so.

Characteristics of the disease.—The primary and peculiar symptoms of peach yellows are only two: (1) The red spotting and abnormally early maturity of the fruit; and (2) the premature germination of ordinary winter buds, or of obscure buds buried in the bark of the trunk and limbs or formed in the cambium. All other symptoms result from these, or are only the common indications of disease and decay in plants.

Plate I, accompanying the original publication of this article, represents two peaches, natural size, one healthy and the other diseased. They are of one variety and were gathered the same day. They were picked from neighboring trees, but might have come from the same tree, since in the first stages of yellows both sorts are usually found upon the same tree. The unspotted peach was hard, green, and normal in all respects. It would not have ripened under two weeks. When ripe its skin would have been creamy white with a blush on one cheek, composed of very minute and nearly uniform crimson punctations. Its flesh would have been melting and juicy, slightly acid, aromatic, and delicious. The color of the flesh would have been uniformly white, except for a narrow zone of crimson immediately surrounding the stone. The diseased peach was fully ripe. Its size was normal; its color abnormal. The skin was beautifully mottled and blotched with crimson, giving an appearance quite unlike that of healthy fruit. Many of these spots were large enough and sufficiently unlike the rest of the skin to admit of being easily photographed. The flesh was also copiously streaked and spotted with crimson. On tangential section these brightly colored portions were usually oval or roundish; on radical section they appeared more often in the form of streaks or elongated spots. There was also more than the usual amount of color around the stone. The flavor of the peach was inferior. This diseased peach was only one out of thousands occurring that year in the infected districts. High-colored, premature fruits are one of the conspicuous symptoms of the disease, and are easily distinguishable even from a car window. In July, 1891, I saw hundreds of bushels of this worthless fruit in upper Maryland and Delaware, and the entire loss thereby in 1891 certainly exceeded half a million dollars.

The amount of color appears to depend somewhat upon variety. Sometimes there is comparatively little crimson spotting, and again, it is a very marked feature, the skin being almost purple and the flesh of the deepest crimson, even in pure white varieties. In an experience covering four years and including a great many thousand trees diseased by yellows, I have known but one in which there was entire absence of red spotting in the fruit. This tree bore premature, insipid peaches and the characteristic shoots. The time of ripening also varies within wide limits. I have known such peaches to ripen forty days in advance of the proper time, and also to ripen with the healthy fruit or only a few days in advance. Generally they ripen two or three weeks in advance and are gone when the healthy fruit matures. In size the prematured fruit is usually normal the first season, and sometimes even noticeably large and showy. If any is produced the second year it is commonly small and inferior. The taste varies as much as the color, running from tolerably good to mawkish or bitter. Such fruits are generally insipid, even when of good size and color, and their sale not only defrauds the consumer but also reacts upon

the grower, seriously impairing the subsequent demand for healthy fruit.

In many cases the red-spotted, prematurely-ripened fruits are the first indications of disease, or at least the first symptoms striking enough to attract general attention. They are very often borne exclusively upon one or two limbs of otherwise healthy-looking trees. These limbs are not different in appearance from the rest of the tree. They bear vigorous shoots and full-grown, smooth, dark-green foliage; often, also, green half-grown fruits, which afterward ripen in a normal manner. There is no indication of disease except in the fruit, which, in color and size, contrasts strikingly with the fine green foliage and the normal immature fruit. Occasionally, in places, the foliage already begins to look yellowish green while weak, pale sprouts begin to push through the bark. Sometimes branches bearing good foliage are covered from base to tip with these feeble shoots. They grow vertically through the bark on the upper surface. Later in summer or autumn, or the following spring, such branches begin to show marked indications of disease. The spring foliage is yellowish or reddish green, dwarfed, rolled, and curled; and the shoot-axes are stunted. Commonly, especially in moist seasons, many feeble, branched sprouts are developed on the trunk and the base of the main limbs. Again, stem and limb shoots will grow normally and very vigorously for several feet and then all at one branch repeatedly near the extremity in a very feeble and peculiar way. Many of these growths are due to the excessive and abnormal development of obscure buds hidden in the deeper layers of the bark or developed from the cambium. Why they should germinate in such numbers, and often in midsummer or autumn, when the tree has passed its period of active growth, remains to be explained. The appearance suggests a profound disturbance of the distributive metabolism of the plant, followed by an equally profound disturbance of the function of assimilation. The branched character of many of the growths results from the premature and abnormal development of ordinary winter buds. These begin to grow as soon as they are formed in the leaf axils, and the feeble shoots to which they give rise develop buds which also germinate the same season, and so on. The winter buds upon healthy-looking terminal branches and stem and limb shoots may also unfold prematurely into diseased growths. This may take place at any time from early spring to late autumn. It is very common in September, October and November, and is one of the striking characteristics of this disease. Plate II represents a shoot taken from the trunk near the earth. Plate III represents one healthy shoot and three diseased shoots taken from the base of main limbs. The spring foliage remains on the healthy shoot (Fig. 2) and its winter buds are dormant. On the contrary, nearly all of the spring foliage has fallen from the diseased shoots and many of the winter buds, terminal and axillary, have germinated. Plates IV and VI represent the same appearances in terminal branches. The prematurity extends also to the blossoms, which generally come out earlier than on healthy trees, and appear sometimes even in autumn. My attention was first drawn to this symptom in the spring of 1890, but extensive observations were then impossible. In the autumn of 1890, and again in the spring of 1891, about 6,000 trees were examined with special reference to the effect of yellows upon the blossoms. All of these trees are in Maryland and Delaware, and all were healthy in the autumn of 1890. About 500 of them were found diseased in whole or in part in the spring of 1891, having developed yellows between fall and

spring. The most characteristic symptom was the general pushing of leaf buds one to two weeks in advance of the proper time. This was peculiarly striking by contrast whenever the trees developed symptoms on one or two limbs only. On many of these trees some of the blossoms also came out very early, and were destroyed by frosts, but in general the disease could be detected in these trees before the blossoms opened.

In this climate, under normal conditions, winter buds of the peach do not germinate until after a considerable period of rest. They never unfold in the autumn, and it is difficult to induce them to do so even in winter. This period of rest may be shortened somewhat by mild winters and early springs, or by artificial means, *e. g.*, June budding, but it is not abrogated in nature, so far as I know, except under the influence of this peculiar disease, and the one described in Part II.

When the winter buds become affected in spring, the growths to which they give rise are occasionally more extensive but are somewhat variable, their appearance depending, of course, to a great extent, upon the length of the internodes and the amount of branching.

So much concerning the characteristics of the disease. Now, in conclusion, some words upon its progress.

Gradually or simultaneously, as the case may be, all of the limbs develop the same symptoms. Consequently, the tree falls into a decline and finally dies. Trees once attacked rarely, if ever, recover. This statement is still in dispute, but I feel quite sure. Hundreds of yellowed and decaying orchards on the upper part of the Chesapeake and Delaware peninsula bear witness every day to the truth of this assertion. In a very few instances I have had trees pointed out to me as once diseased and now recovered, but no such cases have ever come under my own observation. Always such trees have shown symptoms of disease later on, or else there was some uncertainty connected with the original diagnosis of the case.

The duration of the disease varies greatly. If the symptoms progress slowly from limb to limb, the tree may live a long time. If the whole tree is speedily involved, decay and death are correspondingly rapid. I have known trees to die at the end of the first season, but such is not usually the case. In Maryland and Delaware, as well as in regions further north, the affected trees generally live from two to five years, and possibly longer in some cases. Incidentally I am keeping watch of several hundred trees to determine this point more accurately. The trees are worthless from the start and should be removed as soon as the disease appears. If allowed to remain, complete death occurs, very frequently, the third or fourth year, the last feeble sign of vitality being a few yellowish tufts on the trunk or some of the limbs. The tree shown in plate VII*b* was attacked in the spring of 1887, when it was 5 years old, *i. e.*, set 5 years. At that time the tree was remarkably vigorous and handsome. It died in the summer of 1890, *i. e.*, about 3½ years from the time it first developed symptoms, but its foliage was yellowish the second year, and vegetation during the last year of its life was very scanty and feeble, being confined principally to branching sprouts on the bases of the larger limbs.

Generally speaking, the longer the disease has prevailed unmolested in any locality the greater is the number of cases annually, and the less is the probability of getting trees up to bearing age before they are attacked. This peculiar and interesting fact has been observed repeatedly in Connecticut, New York, New Jersey, Maryland, Delaware, and Michigan.

II. INOCULATIONS.

Experiment 1.—The trees selected for this series of inoculations were grown from Smock seed, procured in Kent county, Maryland. They formed a part of a large nursery owned by NORRIS BARNARD, Still Pond, Maryland. When first seen the seedlings were about five months old, and were being worked for commercial purposes. They numbered more than 100,000, and all presented a very healthy, thrifty appearance. The trees devoted to the experiment were in one corner, and not different in appearance from the rest.

The buds for inoculation were cut in an orchard on the Bay farm of JAMES S. HARRIS, Still Pond, Maryland. They came from *diseased shoots* on fifteen or twenty vigorous, four year old trees. These trees had shown no symptoms of disease until that summer, when they bore the red-spotted prematurely ripened fruit as well as the characteristic shoots.

The buds were cut August 12, 1887, and inserted the same day. The manner of insertion was like that ordinarily practiced in reproduction by budding, *i. e.*, the bud, with a portion of the surrounding bark and often some of the underlying wood, was inserted under the bark of the seedling about six inches from the ground, by means of a T-shaped slit. The insert was then bound into place securely by strings, which were cut or loosened at the expiration of ten days. According to their size the trees received one or two buds, none more than two.

In most instances the wood and bark which were inserted healed on quickly and retained their vitality over winter, but there was no growth from the buds that autumn, nor any symptoms of disease in the stocks.

The seedling tops were removed in the spring.

One year from budding these trees were re-examined. Three quarters of the inserted buds had failed to push. Of the rest, some had grown into diseased shoots; others (a few) had grown into shoots which did not yet show the characteristic symptoms of yellows. The effect on the stocks was marked. About thirty-four per cent. of the whole number (202) had become diseased beyond question, while only twenty-three per cent. were entirely healthy. Some of the trees had died during the summer, evidently from the effects of the disease. A few yet living were badly affected, but most of them showed only slight symptoms. Nevertheless, here were the feeble shoots and the winter buds germinating six months in advance of the proper time.

The evidence seemed to be overwhelming and complete, for while the experiment was performed in a region where the disease occurs, it was on a large scale, and moreover the remainder of this nursery, and other nurseries in the same region, subject so far as known to the same influences, were examined in vain for anything which would correspond. The 542 trees in adjoining rows, which were examined critically for comparison, showed no traces of the disease, although all other conditions appeared to be identical. The fact that peach yellows in that locality was comparatively rare in trees under three years of age is also opposed to the view that the proximity of diseased orchards had anything to do with this special case. With a full knowledge of the facts, the conclusion was irresistible that the infection came only from the inserted buds.

An examination made in November, *i. e.*, three months later, showed plainly that the disease was progressing—more trees were dead and fewer were healthy. At that date the number of stocks clearly affected amounted

to forty per cent. The control trees were still free from the disease, although they stood close upon both sides in parallel rows.

Ten of the inoculated and diseased trees were removed that autumn and set in Washington on the grounds of the Department of Agriculture. The remainder were left over winter in the nursery rows. In the spring of 1889 the latter were carefully removed and set out on the farm of Dr. W. S. MAXWELL, some miles distant. None made any growth worth mentioning and all died within a year—some from the shock of transplanting and the rest with plain symptoms of yellows.

The ten trees set on the Department grounds made considerable growth in 1889, and developed into very characteristic specimens of yellows. The germination of the winter buds six or seven months in advance of the proper time occurred freely on many shoots arising from the stock and fully set at rest all lingering doubts respecting the nature of the disease. The foliage was yellowish or reddish, and the total growth as compared with neighboring healthy trees was also very meager and stunted. These trees were again photographed, November 21, 1890, at which time the unbudded seedlings were much larger and still healthy, while the inoculated trees were dead or nearly dead. Between this date and the time when the trees were set, they were examined repeatedly and shown to various persons. During all this period they had unmistakable symptoms of yellows and became gradually more and more feeble. The moving of the trees into different and fertile soil did no good. The five unbudded seedling trees standing in the same row are more than 100 times as large, although one year younger. There was no shock from transplanting, and the difference in size must be ascribed to the stunting effect of the disease. In passing, it is interesting to note that the five healthy seedlings are those noted in my first Report,* p. 145, as having grown from the pits of premature peaches. These trees have continued healthly and now bear a heavy crop of green fruit (July, 1891).

Of the entire 202 trees inoculated August 12, 1887, only three are now living, and each of these is badly diseased and likely to die within six months. Of this experiment it may be said that all doubts concerning the nature of the disease were long since set at rest. It has corresponded exactly in manner of development and in results to the disease in the trees from which the buds came. Exception must, of course, be noted that none of these trees have ever borne fruit.†

The virulent nature of the disease is shown by the fact that only one or two buds, *i. e.*, 1–2 square centimetres of diseased surface, were inserted

* Peach Yellows: A preliminary report. U. S. Department of Agriculture, 1888.

†So far as I know, the only *well-authenticated* case in which buds taken from a diseased tree and inserted into a healthy stock have lived long enough and developed vigorously enough to bear peaches, is one communicated by Prof. E. S. Goff, horticulturist of the State Experiment Station, Madison, Wisconsin. This experiment was begun on the grounds of the Experiment Station at Geneva, New York, in 1886. Professor Goff's statement from memory is as follows:

"The tree budded was a very vigorous seedling of bearing size. In the latter part of the summer of 1886, I budded several of the branches with buds of two (or three?) varieties of the peach, sent me by a young man of western New York whose orchard was badly infested with yellows and who was deeply interested in the subject. He assured me at the time that the buds came from diseased trees.

"More than one half of the buds failed, but several survived and made a good growth the following season, without exhibiting any abnormal appearance. The next season (1888) the branches from the buds bore a good crop of fruit, and the peaches early began to manifest a peculiar appearance, which I recognized from description as yellows. The ground of the fruit became a golden yellow color, sprinkled and blotched on the sunny side with very bright or sometimes with deep red. I am not personally familiar with yellows, having seen but a few trees affected with it, but I came to the conclusion that the branches from the buds inserted into this tree were attacked with the disease. I came away from Geneva in the spring of 1889, and in the fall of that year, anxious to know what further symptoms this tree had manifested, if any, I wrote to Mr. Churchill, who then had charge of the fruit trees, and was informed by him that the tree had died."

Dr. Collier, the present director of the Geneva Station, says that the tree was in an exposed situation and died from an accidental injury.

into each tree. Its slow progress through the tissues is inferred from the fact that no symptoms were visible until after three months, and probably none until the following May or June—eight to nine months after the date of inoculation. It should also be noted that the inserted buds produced the same effect, although cut from many different trees.

Experiment 2.—The trees selected for this series of inoculations were much like those used in No. 1. They were grown from Tennessee seed and formed part of a large nursery owned by THOMAS J. SHALLCROSS, Locust Grove, Maryland. The seedlings numbered about 100,000, and were very thrifty. I first saw them at budding time, when they were about five months old. The trees devoted to this experiment were two outer rows, not different in appearance from the rest.

The buds for inoculation were cut from an orchard on the same farm. They came from *healthy-looking shoots* on a vigorous six-year-old tree. This tree had shown no symptoms of disease until that summer, when some of its limbs bore premature fruit and the characteristic shoots. One limb of the tree was badly diseased only a short distance from where the shoots were cut.

The buds were cut August 3, 1887, and inserted the same day. One bud only was put into each tree. The manner of inoculation was substantially like that already described. Subsequent examination showed that a union between bud and stock had taken place in every instance, or nearly every one, the budder having been very expert. No buds pushed and no symptoms of disease developed that autumn.

In the spring of 1888, while the buds were yet dormant, these trees were removed to Hubbardston, Michigan, and set ten by ten feet apart, principally upon a moderately fertile, sandy loam, which had been used for a garden. This location was selected as, on the whole, the best that could be had at that time. The soil has been cleared of forest and brought under cultivation since 1850. There were and are no known cases of yellows within forty miles, and the nearest commercial orchards are twenty miles away, and not extensive. By long residence I am familiar with the whole country, and believe that the only peach trees in that township or the adjoining ones are such as have been planted very sparingly in gardens or around houses. To most farms and gardens this tree is an entire stranger. The principal objection to the location, and a serious one, was the danger from low winter temperatures and sudden fluctuations, which in the past had frequently killed peach trees to the ground, and consequently had long since very effectually discouraged planting. However, the risk was taken, and, as good fortune would have it, the winters of 1889 and 1890 were so mild that the trees did not suffer in the least.

Altogether, three hundred and thirty-six trees were set, and upon my father's place, that I might have the land more fully under control. Two hundred and ten were the inoculated trees already mentioned and one hundred and twenty-six were unbudded seedlings from the same nursery to be used in making comparisons.

These trees were set out April 24, under personal direction, and were examined carefully, one by one, as late as June 26 of that year. At that date there was no difference in the appearance of the two lots. Six of each were dead, apparently from the shock of transplanting. The remainder of the unbudded trees were perfectly healthy; and the remainder of the inoculated ones appeared to be so, with the exception of one tree which began to look suspicious. In sixty per cent of the inoculated trees

the bud had failed to push, although the bark inserted with it was yet alive in most instances.

In ninety-six per cent. of the seedlings the top was purposely allowed to remain at the time of transplanting, only enough being removed to balance the slight loss of roots. The others were cut back to the inserted bud. The trees suffered no injury in transit, were provided with excellent roots, and, with the exception of eighty-seven set in new ground on upturned and tough sod, grew vigorously from the start and promised well.

In autumn, on several occasions, my father reported that some of the inoculated trees had begun to look yellow and sickly. However, I did not see them until July 1, 1889, *i. e.*, one year from the previous examination and twenty-three months from the insertion of the buds. The change was then so great that I could scarcely credit my eyes. With one exception, the unbudded trees continued healthy and had made a good growth. On the other hand a very considerable number of the inoculated trees were already dead, and most of the remainder were in all stages of decline, dwarfed, yellow, and sickly. Evidently some sort of virus was communicated by the inoculated diseased bud to the previously healthy seedling, and this was probably transmitted to all parts of the tree. At least, symptoms were visible to the very extremities of the branches, three to four feet from the point of inoculation. A few trees only had made a tolerable growth and seemed to be resisting the evil influence.

As in Experiment 1, here were the feeble, branched growths and the winter buds germinating months in advance of the proper time. Again there could be no question as to the nature of the disease. The exact conditions in August were as follows:

TABLE I.—*Result of inoculations two years from the time the buds were inserted as shown by comparison of budded and unbudded trees.*

One hundred and twenty-six unbudded trees.				Two hundred and ten budded trees.			
Healthy.	Doubtful.	Diseased.	Dead.	Healthy.	Doubtful.	Diseased.	Dead.
117	1	0	8	3	16	103	88

From that day to this the contrast has become greater and greater as the condition of the inoculated trees has gone on from bad to worse.

The orchard was reëxamined July 29–31, 1890, and another series of photographs procured. The condition of the inoculated trees was found to be much worse than last year. All which were doubtful or seemed to be healthy in 1889 had become diseased, and many more had died with the characteristic symptoms of yellows. Only two of the inoculated trees made any noteworthy growth in 1890. Of the entire 219* trees which received diseased buds August 3, 1887, only fifteen were living at the expiration of the third year. Nearly all of those which died were more or less stunted and showed symptoms of yellows either in the form of branching summer growths or of winter buds which germinated in autumn.

Up to date only one case of yellows has developed in the unbudded trees, the tree noted as suspicious in 1889.

* Nine were rejected at time of planting on account of injuries received in digging. The number 193 given in my *Preliminary Report* is a typographical error.

A number of the unbudded trees at one end of the orchard died in the spring of 1890 from some unknown cause, not yellows. They dried up suddenly, much as if they had been injured by plowing or by moles. The roots, however, seemed intact and the origin of the trouble was not to be learned in July. It is sufficient that it was not yellows or anything suggestive of that disease. Four of the trees set on sod ground also dried up during the summer. All the rest of these trees (86) made an excellent growth in 1890 and were thrifty and beautiful to look upon.*

For several reasons this experiment is more interesting than No. 1, although the results are identical. First, the inserted buds were taken from shoots that appeared to be healthy; second, the disease developed more slowly than in Experiment 1, owing probably to the different character of the buds; third, a smaller amount of infective material was used; fourth, the inception and progress of the disease occurred in a locality entirely free from yellows. This experiment confirms No. 1. In addition, it proves that yellows may be communicated by parts of a tree which seem to be healthy, and renders it probable that the disease is incubating in all parts of a tree when it appears in any part. In passing, it may be said that the results of the excision experiments described in Part III point to the same conclusion. It is also noteworthy that each of these trees was infected by a single bud, and that all of these buds were cut from a single tree. The inference is very strong that this one tree contained infective material sufficient to destroy entire orchards if properly introduced into the trees. Both experiments go to show that the germ or virus of the disease must be quite uniformly distributed through the affected parts.

Experiments 3 and 4 (the R. G. NICHOLSON trees and the D. P. BARNARD trees) are incomplete, owing to the temporary discontinuance of this investigation in the spring of 1888.

At the time of removal Mr. BARNARD reserved ten trees from experiment 4, and set them with others of the same age in an orchard on his farm. According to his statement, January 10, 1889, they made a good growth in 1888 and were healthy as any trees. September 20, 1890, Mr. BARNARD reported that the trees were still healthy, but they were not personally inspected until January 26, 1891.

At that date the following conditions prevailed: One tree was gone; one tree had made no growth worth mentioning and was dead with symptoms of yellows; three were much smaller than should be and were suffering from yellows or at least presented what seemed to me satisfactory symptoms; one was doubtful; and four were nice trees. The latter had made a reason-

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* These trees were re-examined August 12, 1891, with the following results:

Average height of the north two rows (37 trees), 9.9 feet; average circumference of trunk, 8 inches. Average height of the south three rows (49 trees), 8.1 feet; average circumference of trunk, 5.7 inches. Twelve of the trees have mildewed badly this year, one has yellows, and several others are small. Otherwise all are healthy and growing vigorously. The difference in amount of growth is referable to the unlike methods of treatment. They have been cultivated with crops as follows:

Plot.	1888.	1889.	1890.	1891.
North two rows	Corn and cucumbers	Corn	Strawberries	Strawberries.
South three rows	Corn	Wheat	Clover	Corn.

The growth of a crop of wheat in 1889 and the absence of cultivation the following year, when the trees were in clover sod, checked the growth of the south three rows nearly one third. Of the inoculated trees only six remain, and they are like the three left from Experiment 1.

able growth and appeared to be free from disease. These trees were budded in a locality where yellows is very prevalent and have remained there ever since, *i. e.*, over three and a half years. Therefore, it can not be asserted unqualifiedly that the diseased trees resulted from the insertion of diseased buds, since the possibility of subsequent infection is not excluded. The possibility, however, is not great, because the trees were badly dwarfed, as if they had been diseased from the start. The trees which still appear to be healthy are, therefore, the only really interesting ones. Their behavior during the next year or two will be a matter of considerable interest, as throwing additional light on the question whether the whole tree is diseased when symptoms appear in any part of it.

For this experiment the buds were selected with great care from *terminal branches* upon the healthy-looking side of a diseased seedling tree which was about four years old. If any portion of the tree was free from the disease these branches should have been. The buds were cut and inserted September 7, 1887. The tree from which they were taken manifested symptoms of yellows in all parts in the spring of 1888, and died that summer.

One failure of another kind remains to be recorded. A large and vigorous seedling tree in the yard of Prof. CLEVELAND ABBE, in Washington, was inoculated in a dozen terminal branches with buds taken from one of the ten trees set on the Department grounds and described under Experiment 1. The buds were cut August 15, 1889, and inserted the same day. The growth of the tree from which the buds came had been stronger and healthier-looking than that of the others, but fully one half of the winter buds were then germinating and the inserted buds were of this character.

This tree has remained healthy, but no stress should be laid upon the fact, because, owing to the use of a dull knife or to the fact that the shoot-axes had already pushed, all of the buds dried up in a few days and entirely failed to unite with the branches. So far as relates to the propagation of yellows it must be classed with pruning and other experiments of simple contact and I have not yet obtained any indisputable evidence that the disease can be spread in this way, although it seems very probable. Several extensive experiments of this kind are now in progress. In Experiments 1 and 2, in all or almost all of the inoculations, there was a distinct union between the bud and the stock, *i. e.*, between the diseased and healthy tissues, some months prior to the first appearance of symptoms in the stocks.

Experiment 5.—In order to be absolutely certain as to the healthy character and sound constitution of the seedlings, stones were procured in quantity from three localities free from yellows. These were planted November 8, 1889, upon well drained and fertile soil in the grounds at the Department of Agriculture. Row No. 1 were Tennessee pits. "These pits were bought of JOHNSON & STOKES, Philadelphia, and came from London, Tennessee." I procured them from CHARLES WRIGHT, Seaford, Delaware. Row No. 2 came from Sussex county, Delaware, and were also procured from Mr. WRIGHT, who had purchased them for his own use. Concerning them he wrote: "The Delaware pits were collected by myself of WILLIAM P. BROWN of Seaford and were saved from old seedling trees in his orchard near town." Row No. 3 came from Caroline county, Maryland. They were collected by J. W. KERR of Denton for his own use.

The seedlings came up satisfactorily and made a good growth in the season of 1890. About 100 of each row were inoculated and the rest were reserved for future experiments.

The buds for inoculation were selected with the greatest care from seventeen diseased trees in the older orchard of JAMES W. GREEN, Magnolia, Delaware (No. 14 of first report). I did not have an orchard map when the buds were cut, but, judging from the appearance of the trees, all were cases of 1889. Each one was plainly diseased by yellows, but none were wholly diseased, *i. e.*, none appeared to be so. One third to one half of each tree was more or less yellow and bore the diseased shoots, but the other side was green and thrifty and although examined very minutely gave no indication of disease. Two shoots were taken from each tree (different limbs). These were two to three feet long, robust, well matured for the time of year, and to all appearances perfectly healthy. Each shoot came from the healthy-looking side of the tree, and all bore smooth, green, and vigorous leaves, six to nine inches long. Better *looking* buds were never used. These shoots grew out at much greater distances from diseased parts than those used for Experiment 2. They were cut July 18, 1890, immediately stripped of foliage, and wrapped in damp cloths. Row 1, was budded July 19; row 2, July 21; and row 3, July 22. All of the buds were used except some on the base of the shoots which proved too large for the stocks. Two buds were put into each seedling, but owing to dry weather and unskillful manipulation, many of them failed to unite with the stock. Others healed on satisfactorily but made no growth. Still others made a growth of one to ten inches although the upper portion of the stocks was purposely left uncut in order to prevent this.

The stocks were healthy (December 13, 1890), and it was only the few buds which had already developed into shoots that I desire to notice here. None of these appeared to be perfectly healthy, and some of them had developed very characteristic symptoms of yellows. Since then there have been new developments. At this date (July 16, 1891), twenty-eight stocks show symptoms of yellows, and the foliage on five or six vigorous shoots, which have grown from inserted buds, begins to take on a peculiar yellow tint very suggestive of this disease. There are cases in each of the rows, but most at present in the S. row.

This experiment is, in part, a repetition of No. 2. Whether these trees (the stocks) will all perish in the same way remains to be seen. Another point important to be settled is whether *any* of the inserted buds will develop into healthy trees. The seedlings will be transplanted at an early date to a locality entirely free from yellows and kept under observation until this can be determined.

III. EXCISIONS.

Symptoms of peach yellows, as already noted, frequently appear at first on one branch only, or on one side of a tree, while the rest remains for several or many months, to all appearances, perfectly normal. The symptoms of the disease are progressive from part to part until the whole tree is involved, and this has favored the idea that the disease is local at first and only constitutional or universal after the lapse of considerable time. Generally, in bearing years the earliest plain symptoms are found in the fruit, and this fact has led to a strong popular belief that the disease is communicated from tree to tree by pollen, through the instrumentality of bees or otherwise. There is, however, absolutely no foundation in observation for any such belief. The following experiments were undertaken in the hope of determining whether the disease is local or constitutional

when the first symptoms appear. Assuming that the cause of the disease is a contagium which has gained an entrance into the tree through such blossoms as develop into prematurely ripened fruit, then it follows that the disease is first of a local nature, as the appearances indicate; and it would seem that it might be removed, in some cases at least, if the excisions were vere very prompt and rigorous. Anyway, this was the theory on which I proceeded.

The experiments are as follows:

A.—*Orchard of William Brothers, Dover, Delaware.*—Trees set three and a half years; both of them cases of 1887; selected out of twenty-seven as being most suitable for this experiment. The limbs which bore affected branches were cut away close to the body of the tree, and the stumps were painted.

(1) September 16, 1887. Variety, Beers' Smock. This tree seemed to be healthy, except parts of one large limb. This limb showed slight beginnings of diseased sprouts, and bore one peach, which was ripe, red-spotted on the skin and red-spotted and streaked in the flesh. The limb was removed.

Result.—August 16, 1888. The tree is full of peaches, and three fourths of them are now ripe and red-spotted. The proper time of ripening of this variety in this locality is about the middle of September. Only two small limbs bear green, healthy fruit. The foliage of the affected limbs is yellowish, and they bear a few small diseased shoots.

(2) September 16, 1887. Variety not recorded. This tree bore no fruit, but diseased sprouts have developed on one limb, and to a greater extend than on No. 1. This limb was cut away. The rest of the three seemed to be healthy.

Result.—August 16, 1888. The tree is badly diseased. It now bears premature fruit on all parts. Also on all of the main limbs there are many diseased shoots, and some of them are large.

All of the diseased trees, except those two, were removed in 1887.

B.—*Orchard of James W. Green, Magnolia, Delaware.*—Trees set five and a half years; all cases of 1887; selected out of several hundred as being freest from symptoms of yellows. In all of these trees the disease appeared to be localized on one or more of the several main limbs. In fact, I was at great pains to select trees which showed the premature peaches and feeble shoots only upon a few limbs. Many otherwise promising trees were rejected because of slight symptoms upon the base of the main limbs. In several cases there were yet no diseased sprouts. In none were there very many. In some of the trees healthy shoots of that summer had grown out between the diseased parts and the point of amputation. The limbs were sawed off smoothly and the stumps were painted. Whenever a small diseased branch joined a larger healthy limb I severed both, cutting below next to the body of the tree in order to be more certain of success. In most cases, from one third to one half of the tree was removed. All that was left, and much of what was cut away, appeared to be perfectly healthy. In some trees the symptoms of disease were more pronounced than in others, but the final results were the same.

(1) September 15, 1887. Variety, Beers' Smock. Two main limbs were removed; five of the same size were left.

Result.—August 17, 1888. The tree now bears premature fruit on every main limb. It also bears diseased shoots. Some of the smaller branches bear a few sound peaches.

(2) September 15, 1887. Variety, Beers' Smock. Three limbs were removed; three were left.

Result. August 17, 1888. The tree bears many peaches, most of which are premature. Upon two of the three main limbs, some branches only still bear green, healthy peaches. The trunk and limbs also bear diseased shoots.

(3) September 1, 1887. Variety, Beers' Smock. One small limb, one and a half inches in diameter at the base, was removed; four large limbs with many branches were left.

Result.—August 17, 1888. The tree is now badly diseased in every limb, and bears almost nothing but premature fruit, *i. e.*, there are not over forthy green peaches on the entire tree. Diseased shoots have also grown from every limb and from the trunk near the earth.

(4) September 15, 1887. Variety, Beers' Smock. A smaller tree than No. 3. One limb was removed, two were left.

Result.—August 17, 1888. One of the two main limbs bears green, healthy peaches; the other bears mixed fruit. That on two branches is premature; that on three others is healthy. There are no diseased shoots.

(5) September 15, 1887. Variety, Beers' Smock. A large, fine tree. One limb was removed, four limbs were left,

RESULT.—August 17, 1888. The tree is now full of fruit and at least one half of it is premature. The diseased peaches are not confined to any special part but are borne on all of the main limbs. There are also characteristic, feeble shoots on the trunk.

(6) September 15, 1887. Variety, Beers' Smock. A large tree. One limb was removed, four were left.

RESULT.—August 17, 1888. Two of the four limbs bear green, healthy peaches; and two bear premature ones, far out toward the ends of the branches. Diseased shoots have also grown from the base of these two limbs and from the trunk below the excised limb. There are a few green peaches on the prematured limbs.

(7) September 15, 1887. Variety, Wilkins' Cling. Two limbs were removed, three were left.

RESULT.—August 17, 1888. One limb is sound, i. e., no symptoms have developed. The other two bear mixed fruit; on some branches it is premature and now fully ripe, on others it is healthy and still green. Both limbs bear branched and very characteristic yellow shoots.

(8) September 15, 1887. Variety, Wilkins' Cling. One branch was removed from a large limb. The remainder of this limb and three other limbs were left.

RESULT.—August 17, 1888. One limb bears green, healthy peaches; the others bear prematurely ripe fruit and branched and unbranched yellows shoots. But some branches bear sound peaches. The limb from which the branch was removed is not worse affected than another on the opposite side of the tree.

(9) September 15, 1887. Variety, Wilkins' Cling. One small limb was removed; three larger ones were left.

RESULT.—August 17, 1888. Most of the peaches on this tree are green and healthy but branches upon two of the three limbs bear ripe red-spotted peaches and the diseased shoots.

(10) September 15, 1887. Variety, Beers' Smock. One limb was removed; three limbs were left.

RESULT.—August 17, 1888. There are many premature peaches on all parts of the tree, but some of the branches still bear green ones. There are no sickly shoots.

(11) September 17, 1887. Variety, Crawford's Late. One limb was removed, three were left.

RESULT.—August 17, 1888. Most of this tree is healthy, *i. e.*, appears to be. Two branches of one limb only bear premature, ripe fruit, and small feeble shoots. A large branched shoot, very typical of yellows, has also grown from the body below the excised limb.

(12) September 17, 1887. Variety, Crawford's Late. Two limbs were removed; three were left.

RESULT.—August 17, 1888. There are premature peaches and characteristic yellows shoots on every main limb. Some of the branches on these limbs also bear green, healthy fruit.

(13) September 17, 1887. Variety, Oldmixon. One limb was removed; three were left.

RESULT.—August 17, 1888. Most of the tree bears green, healthy peaches. One limb, however, bears nothing but ripe prematures. A small branch on another limb also bears this kind of fruit. The sickly shoots have developed on both and on the trunk below the excised limb.

(14) September 17, 1887. Variety, Oldmixon. Two limbs were removed; three were left.

RESULT.—August 17, 1888. All of the main limbs bear premature peaches and diseased shoots. There are also two much-branched, yellows shoots on the trunk—one below the excised limbs and one on the opposite side. The tree still bears some green, healthy peaches.

(15) September 17, 1887. Variety, Stump-the-World. One limb was removed; three were left.

RESULT.—August 17, 1888. One limb bears green, healthy peaches. The other two bear mixed fruit, *i. e.*, premature, fully ripe peaches on some branches and immature normal ones on other branches. There are no diseased shoots. One small branch on this tree bears premature peaches upon three twigs, and green peaches upon two others. One of the latter is three inches and the other is fourteen inches below the lowest twig bearing the prematures. The foliage and bark on this branch appear to be perfectly normal, and I can see no difference between the twigs bearing sound peaches and those bearing diseased ones.

(16) September 17, 1887. Variety, Stump-the-World. One limb was removed; three were left.

RESULT.—August 17, 1888. This tree bears a great quantity of fruit and only a very

little of it is premature. One diseased shoot has grown from under the excised limb, and there are several noticeable ones at the junction of the stem and roots. Otherwise the foliage is normal and the tree appears to be healthy.

(17) September 17, 1887. Variety, Stump-the-World. One limb was removed; four were left.

RESULT.—August 17, 1888. There are premature peaches and numerous diseased shoots upon every limb. Some of the shoots are much branched.

(18) September 17, 1887. Variety, Stump-the-World. One limb was removed; three were left.

RESULT.—August 17, 1888. This tree bears only a few peaches. On two limbs there are a few prematures, and one shoot which has grown from the trunk beneath the excised limb does not look perfectly healthy. The foliage of the tree is normal, and as in No. 16 the symptoms are slight.

(19) September 17, 1887. Variety, Stump-the-World. One limb was removed; three were left.

RESULT.—August 17, 1888. There are premature peaches on every limb, and also many diseased shoots. There are sound peaches on one branch of one limb only.

These nineteen trees were reëxamined in the autumn of 1889. All of them were then yellowish and quite badly affected. Few bore any fruit. They were again examined in the autumn of 1890. At that date all of the shoot-axes were dwarfed, many winter buds were germinating, and the trees bore no healthy foliage. The leaves were stunted and pale green, yellowish or red. Many branches were dead, but no entire trees. They bore no fruit in 1890.

So far as I can see, the progress of the disease in these trees was not retarded by the excisions. They are now neither better off nor worse than any other cases of 1887, left for comparison. In 9, 16, and 18 the symptoms on the remaining limbs were not very numerous in 1888, but I can not be sure that such might not have been the case in any event, because sometimes the entire tree does not succumb, until the third year.

C.—*Orchard of George Gildersleve, near Rising Sun, Delaware* (G. D. Jackson, tenant).—Trees set 6 years; all cases of 1887; selected out of several hundred as being freest from symptoms of yellows and, therefore, most suitable for the experiment. The trees were free-growing, thrifty specimens, and in each the disease appeared to be localized on the upper part of one limb. This was cut away next to the stem and the stump was painted.

(1) September 19, 1887. Variety, Smock. One main limb was removed; two were left.

RESULT.—August 18, 1888. One of the limbs bears premature peaches on all parts, and also many diseased shoots. The other bears green, healthy peaches, and shows no indication of disease.

(2) September 19, 1887. Variety, Smock. One limb was removed; four were left.

RESULT.—August 18, 1888. This tree bears healty fruit and foliage on all parts, except one branch of one limb. This bears premature peaches and about thirty diseased shoots. The effects of the disease are also apparent in the spring foliage and in the terminal growths. The union of this branch with the main limb, which otherwise seems healthy, is four feet above the stump of the excised limb.

(3) September 19, 1887. Variety, Reeves's Favorite. One limb was removed; two were left.

RESULT.—August 18, 1888. This tree now bears only a few peaches. There were no prematures, unless a few may have ripened very early and disappeared. The foliage is healthy, and the only indications of disease are copious yellows shoots on the trunk at the earth's surface, just below the excised limb.

D.—*Orchard of John A. Nicholson, Leipsic, Delaware.*—September 21, 1887. An effort was made to cut the disease from three trees forming part of a three year-old, thirty-nine-acre orchard on the farm of John A. Nicholson, near Leipsic, Delaware. There were nineteen diseased trees and I selected the ones which seemed most favorable, removing large limbs.

This orchard was not revisited, but I was told that the remainder of each tree showed yellows the following season and there were 500 new cases.

All these experiments were begun in mid-September. The next year I repeated the experiments in other orchards, cutting away the limbs in August, *i. e.*, five weeks earlier.

E.—*Orchard of George Davis, Still Pond, Maryland.*—Trees set nineteen years; cases of 1888; selected from about fifty as most suitable for the experiment. The trees were very large and vigorous for their age, trunks, about one foot in diameter; height, twenty-five to thirty feet. I was particular in the selection of trees and cut back very severely,

wasting much good fruit. The limbs were severed next to the body of the tree and the stumps were painted.

(1) August 9, 1888. Variety, not recorded. The tree was full of peaches, nearly all of which were green and healthy. Two small branches had been cut away recently because they bore premature fruit. The large limb which had borne these branches still bore a few ripe, red-spotted peaches, but most of its fruit was healthy. This limb was cut away next to the trunk, the stump being six inches in diameter and sound. Part of the other main limb, with much sound fruit, was also cut away because a few twigs on one branch bore premature fruit. One comparatively small limb was left. This bore green peaches and appeared to be perfectly healthy. There were yet no diseased shoots on any part of the tree.

RESULT.—September 20, 1889. Tree gone. Supposed to have been removed accidentally in the spring or summer on account of disease, the order being to remove all diseased trees.

(2) August 9, 1888. Variety, Mountain Rose. A small branch which bore premature peaches had been removed recently, and another small branch on the same limb bore the ripe and red-spotted fruit. There were no other indications of disease. Even on this limb nine tenths of the fruit and all of the foliage appeared to be perfectly normal. The limb was cut away close to the trunk. The sound stump was seven inches in diameter The limb which remained bore thrifty foliage and was full of green, healthy peaches. A very careful examination of all parts showed no trace of disease.

RESULT.—September 20, 1889. There is no fruit. One branch bears three diseased shoots, but the spring foliage of the tree is still normal in size and color.

(3) August 9, 1888. Variety, Reeves's Favorite. Parts of one limb showed symptoms of disease; a small branch had been cut away recently on account of yellows and two other small branches bore large, red-spotted, ripe fruits, which were in very marked contrast to the unripe peaches upon the remainder of this limb and upon other parts of the tree. Eighteen inches above the cut a feeble shoot, one fourth inch long, was pushing through the rough bark. Eighteen inches further up the limb was a shoot, two to three years old, which bore diseased sprouts on its base and also six feet above in its top. These sprouts were small, *i. e.*, recent growths. There were no other diseased sprouts on the tree, and, even on this shoot, most of the buds were dormant and most of the foliage was green and full grown. The limb which bore these premature peaches and diseased sprouts was cut away close to the body of the tree, although almost the whole of it bore only healthy fruit and all of it bore only dark-green and vigorous spring foliage. The stump was six inches in diameter and decaying at the center. One limb remained. This bore green, healthy peaches upon all of its branches. Its foliage was also full-grown, dark green, and very healthy in appearance. There was not the least indication of disease.

RESULT.—September 20, 1889. There is no fruit. This tree now bears an abundance of healthy foilage and there are no diseased sprouts or other indications of yellows—none whatever.

This tree was reëxamined October 20, 1890, and found to be diseased in all parts.* The wind had blown away the top 9 feet above the ground, but three small branches remained. These bore many diseased sprouts. The trunk also bore similar sprouts.

F.—*Orchard of George Davis, Still Pond, Maryland.*—Trees set five years; cases of 1888, selected out of about thirty as most suitable for the experiment. The whole orchard was thrifty and fair to look upon.

(1) August 9, 1888. Variety, Smock. Two limbs were removed; one was left. Those which were cut away bore premature peaches. The one which was left bore green fruit, and seemed to be healthy.

RESULT.—September 20, 1889. Still diseased.

(2) August 9, 1888. Variety, not recorded. This tree ramified near the ground into three main limbs. Two small branches on one of these limbs bore premature peaches. The remainder of that limb, *i. e.* most of it, and the rest of the tree, bore green, healthy fruit. There were no diseased sprouts, and no other indications of yellows, the foliage of the whole tree being green, full-grown, and healthy.

RESULT.—September 20, 1889. The tree is now diseased in all parts.

G.—*Orchard of F. H. Harper, Still Pond, Maryland.*—Trees set seven and one half years; all cases of 1888; selected out of several hundred as being freest from symptoms of yellows, and therefore most suitable for the experiment. As in Mr. Greene's orchard and elsewhere, many otherwise promising trees were rejected because of slight symptoms on the base of some of the main limbs. All of these trees were free-growing and thrifty. None of the spring foliage was rolled, curled, or yellowish, except upon one tree. The fine green color and robust growth of this foilage, even on affected limbs, was very noticeable. The trees were freer from symptoms of disease than at Mr.

* See note to G 3.

Greene's, but a larger portion of each was cut away. In fact, the excisions were very severe and wasted a great many baskets of good fruit. Roughly stated, I removed from one third to two thirds of the whole top of each tree, only a small portion of which in most cases showed any indications of disease. The limbs were cut close to the body of the tree, and their stumps were carefully coated with paint. These were three to four inches in diameter.

This orchard was believed to be well adapted to the experiment because of the healthful appearance of the trees, and because of the very gradual manner in which many of them had succumbed to the disease in 1887 and 1888. The cases of 1887 were dug out and removed that fall or the following spring; the cases of 1888, exclusive of the trees under consideration, were cut back to the stem that autumn, but were not removed until the end of the next growing season.

(1) August 10, 1888. Variety, Christiana. One limb was removed; two limbs were left. The excised limb bore premature fruit on a small portion only, *i. e.* two small branches. The remainder of its fruit was green and healthy. The limb was sound and there were no diseased sprouts. The fruit upon the remaining limbs was green and healthy and the foliage was excellent.

RESULT.—May 13, 1889. Apparently healthy.

September 17, 1889. Still diseased; slight symptoms upon two limbs. No fruit this year.

October 11, 1890 Tree decidedly inferior-looking. Foliage, red, yellow, dwarfed, and rolled. In marked contrast to neighboring healthy trees. Tree, very twiggy; many of the small, unbranched, sickly shoots which grew early in the season have dried up. A few winter buds are now pushing, and the terminal buds on a number of shoots germinated about six weeks ago. No fruit this year.

(2) August 10, 1888. Variety, Oldmixon. One limb was removed; two limbs were left. The excised limb bore sound, green peaches on nearly all parts; but there were premature peaches on one small branch. Foliage, excellent; no diseased sprout; stump, sound. The limbs which were left bore green peaches and beautiful foliage.

RESULT.—May 13, 1889. Apparently healthy.

September 18, 1889. Still diseased, but the symptoms are slight. No fruit this year.

October 10, 1890. Plainly diseased in all parts. The spring foliage is reddish. Some weeks ago many terminal buds pushed on branches in the top of the tree, and each now bears a whorl of pale green, spindling leaves, two to three inches long. On many of these branches the lower buds have also germinated, but more recently. The same symptoms occur on a dozen shoots which have grown from the base of the main limbs. No fruit this year.

(3) August 11, 1888. Variety, Oldmixon. One limb was removed; one was left. The excised limb branched into two equal forks 16 inches above the cut. The stump was sound and the foliage on both forks was full-grown, green, and healthy. All of the fruit on one fork was green and healthy. Most of that on the other was also green and healthy, but two small branches bore ripe, red-spotted fruit, and also two diseased shoots each only about one fourth inch long. The remaining limb bore green peaches and perfectly healthy foliage. There was not the least sign of yellows.

May 13, 1889. Doubtful. Vegetation is not far enough advanced to tell positively.

September 18, 1889. Excision apparently entirely sucessful. No symptoms of yellows. There are no diseased sprouts or germinating buds. The foliage also is thrifty and of the proper form and color. Half a dozen vigorous shoots have grown from the base of the remaining limb. These are two to three feet long and bear excellant foliage. No fruit this year.

October 10, 1890. The tree is now diseased, but the symptoms are confined to one shoot. This grew in the summer of 1890 upon the base of the main limb. It is robust, unbranched, and two feet long. The terminal bud developed some time ago, has grown two and a half inches, and now bears a whorl of immature leaves. Below, on the same shoot, a dozen buds have germinated recently and sent out leaves which are one fourth to three fourths inch long.

Otherwise the tree looks as well as its healthy fellows, and but for this one shoot I should certainly think it sound.

Apparently the disease was not removed by the excision, but has hung about the tree or been dormant in it, ever since 1888.*

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* On September 29, 1889, Mr. J. Frank Wilson, of Still Pond, Maryland, took me to a tree in one of his older orchards, No. 4 of my first report, which then appeared to be perfectly healthy, but which he said had shown unmistakable symptoms of yellows in the fall of 1888, at which time he had cut away all but one small limb. At the date of my visit this limb seemed likely to grow into a new and healthy top. This tree was reëxamined October 15, 1890, and found to be so badly diseased in all parts that I was compelled to believe that it had not been free from disease at any time since 1888, although it developed no sypmtoms in the season of 1889.

Several cases similar to this one have come under my observation, but usually the period of immunity has been shorter.

(4) August 10, 1888. Variety, Oldmixon. Two limbs were removed, both from one side. On one of these limbs was a small branch bearing eight or ten premature peaches, on the other were two small branches each bearing 10 to 12 premature peaches. The remainder of the peaches on both limbs, 200 or more, were green and healthy. The spring foliage was abundant, full-grown and healthy. A few small diseased shoots, one half inch long, were pushing from the base of a small limb three feet above the cut. There were no other signs of disease and the stump was sound. The foliage upon the rest of the tree was entirely healthy. The peaches were numerous, green, and normal.

May 13, 1889. Apparently still diseased. Some puny-looking sprouts are growing from the base of the excised limbs and from the trunk under them.

September 17, 1889. To casual observation this tree is as healthy as No. 3, but I find scars on the stub of the excised limb from which some one has broken shoots. A search in the weeds under the tree brings to light several dried-up, much-branched, and quite characteristic yellows shoots, which correspond to the scars on the stub. There are no present indications of yellows, but unquestionably the tree is diseased. No fruit this year.

October 11, 1890. Most of the foliage has fallen, probably nineteen twentieths. Some of it is redder than should be. It is not yet a bad-looking tree, although plainly diseased. Winter buds are now germinating on half a dozen shoots. I counted fourteen on one not over a foot long.

(5) August 10, 1888. Variety, Reeves's Favorite. One limb was removed; one was left. The excised limb bore 25 to 30 premature peaches, distributed on two branches. The rest of the limb bore many sound, green peaches. There were no diseased sprouts, and the foliage of the entire limb was full-grown, and of a healthy green. The limb which was left bore green, healthy peaches and healthy foliage.

May 13, 1889. Apparently healthy.

September 17, 1889. There are now slight but unquestionable symptoms of disease, *i. e.*, a half dozen feeble shoots on the trunk and limbs. The spring foliage is dark green and thrifty. No fruit.

October 11, 1890. The tree is well provided with good foliage, and there are only a few diseased shoots. One is a terminal bud which has grown about one half inch, developing a whorl of immature leaves now two to three inches long. Another is a small, feeble shoot on the trunk.

(6) August 10, 1888. Variety, Reeves's Favorite. One limb was removed; one was left. The excised limb tri-parted a short distance above the cut; two of the tree parts bore premature peaches upon some branches and green ones upon others. The third fork bore only green, healthy fruit. The foliage of this tri-partite limb was full-grown, green and healthy. There were no diseased shoots and the stump was sound. The remainder of the tree bore green, healthy peaches, and excellent foliage. There was not the least sign of yellows.

May 13, 1889. Appears to be diseased.

September 17, 1889. At first sight this tree appears to be as healthy as No. 3. The entire foliage is vigorous and of a healthy green. Seven lusty shoots have grown out of the trunk just below the excised limb. These are three to four feet long, and most are one half inch in diameter at the base. All look healthy and bear excellent foliage. However, on the base of the remaining limb, four inches from the cut, there is a scar easily overlooked. Some one wrenched a shoot from this spot in the summer. Search in the weeds under the tree brings it to light. This shoot is two and a half feet long and branched in the characteristic manner. There is, therefore, no doubt that the tree is still affected, although at present it shows no symptoms of disease. No fruit this year.

October 11, 1890. Tree much like No. 5. There is an abundance of good foliage, but upon two shoots about a dozen winter buds are now pushing.

(7) August 10, 1888. Variety, Beers' Smock. One limb was removed. This limb bi-parted just above the cut. On one fork two small branches bore about a hundred red-spotted peaches which were ripe or nearly ripe, while five or six others of about equal size bore only green, healthy fruit. The other fork bore nothing but healthy peaches. There were no diseased shoots, and the foliage of the entire limb had every appearance of health. The stump was sound. The rest of the tree seemed healthy. It bore sound, green peaches, and full-grown, green foliage.

May 13, 1889. There are diseased shoots at the base of the excised limb. A few have also grown from the base of the adjoining limb.

September 17, 1889. Still diseased. The symptoms are confined principally to the stump of the excised limb and to one other limb, the top of which was cut out in the spring or summer during my absence. No fruit this year.

October 11, 1890. Not recovered and not better looking than other diseased trees in the same orchard. All of the foliage which remains is unnaturally rolled, curled, red and yellow. The tree bears diseased sprouts and some of its winter buds are now pushing.

(8) August 10, 1888. Variety, Christiana. One limb was removed; three were left. The excised limb biparted eight inches above the cut. One fork bore 230 premature peaches and only a few healthy green ones. On the lower part, pushing from the bark, were several diseased growths each only about one half inch long. One of these was within eighteen inches of the cut. The spring foliage was full-grown, dark green and healthy. The winter buds were dormant and there were no other indications of disease. The other fork, which was of the same size or a little larger, bore healthy foliage and between two and three hundred healthy, green peaches. The limbs which remained appeared to be perfectly healthy. They bore only green peaches and healthy-looking foliage.

May 13, 1889. Apparently still diseased. There are some feeble shoots with reddish foliage on the main limbs near the trunk.

September 17, 1889. The symptoms of yellows are more apparent on this tree than on any of the preceding seven, yet the tree would not be called badly diseased. There is no fruit to judge by, but the spring foliage on the entire tree is somewhat curled and yellowish. There are also a number of feeble shoots, and winter buds are now germinating in a number of places upon both the main branches of a limb opposite to the one which was excised.

October 11, 1890. Most of the foliage has fallen; what remains is unnaturally rolled, curled, and red. The tree is rather twiggy from last year's diseased shoots now dead. On one branch and on one stem-shoot, the winter buds are now germinating. Not many diseased sprouts appeared this year and the tree has made a fair growth.

(9) August 10, 1888. Variety, Oldmixon. One limb was removed; two limbs were left. The excised limb biparted fourteen inches above the cut. The larger fork bore 100 to 200 healthy, green peaches; the smaller fork bore about one half as many premature peaches, but also some green ones on the top branches. A few sprouts near the base of the smaller fork are not quite healthy, and the smallest, which is only about one half inch long, is not over two feet above the cut. The stump was sound, and the spring foliage on the entire limb was full-grown and healthy. The peaches and foliage on the remaining limbs were perfectly healthy in appearance.

May 13, 1889. Signs of disease are now visible on the trunk just below the stump of the excised limb.

September 17, 1889. Still diseased. A tuft of yellowish, much-branched, feeble sprouts has grown from the stub of the excised limb. One of the main limbs bears diseased growths at its base, six feet above, and on the extremities of several branches, at a distance of over ten feet from the trunk. The other main limb looks healthy, except that the terminal buds on two thrifty "watershoots" began to grow in August, something very unusual in healthy peach trees in this climate, although not uncommon in Georgia in midsummer. The spring foliage on both limbs continues to look healthy.

October 11, 1890. Most of the foliage has fallen. The remainder is unnaturally reddish. Terminal buds pushed some time ago in the top of the tree, and several lusty stem-shoots are now full of germinating buds.

(10) August 10, 1888. Variety, Reeves' Favorite. One limb was removed. It bore twenty to thirty green peaches and about the same number of fully ripe ones,* but none of the latter were within ten feet of the cut. There were no diseased sprouts or germinating winter buds. The foliage was full-grown and entirely healthy. The remaining limbs bore healthy peaches and excellent foliage. One small shoot, however, on the base of the east branch, did not appear quite right, yet I could not say it was affected by yellows. It was fourteen inches long and unbranched. The leaves were somewhat paler than normal and were attacked by a shot-hole fungus, which is quite common on the leaves of diseased trees.

May 13, 1889. The entire top was blown away by a tornado which occurred soon after the excision, but the stubs of the limbs appear to be diseased.

September 17, 1889. Numerous yellowish, much-branched, feeble, spindling shoots have grown from the stub.

October 11, 1890. The trunk is now dead.

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* The premature peaches on this tree, like those on all the others, were large and showy; the skin was red-spotted and high colored; the flesh was also much streaked and spotted with bright red. Many of these spots were to be seen on radial as well as tangential sections. They were about one sixteenth inch in diameter, and were not confined to the fibro-vascular system, but formed part of the ordinary parenchyma of the fruit. The streaks of color were limited principally to radial sections, but did not extend from pit to skin. Some of these peaches tasted very well; others were insipid or sickish. Sometimes, even, one half of a peach tasted well and the remainder was not palatable.

(11) August 10, 1888. Variety, Reeves's Favorite. One limb was removed. This subdivided two and one half feet above the cut into four branches, three of which bore a few large, ripe peaches, while the fourth bore about twenty green ones. The proper time for the ripening of this variety in that orchard is August 20. The foliage was full-grown and healthy-looking, and there were no diseased shoots either from winter buds or obscure buds.† The stump was sound. The remaining limbs bore healthy, green peaches and excellent foliage. There was no sign of yellows.

May 13, 1889. The entire top was blown away by the tornado. There are no vigorous shoots on the trunk or stubs of the limbs, but only three or four buds pushing feebly and two small, dried-up shoots. The stump looks nearly dead, but this is probably due in part to the effect of the wind.

September 17, 1889. Dead. No growth of any sort since spring.

(12) August 10, 1888. Variety, Reeves' Favorite. One limb was removed. This bore about twenty large, showy, ripe peaches, and about the same number of much smaller green ones—all of the latter upon one branch. There were no diseased shoots; the foliage was healthy; and the stump was sound. The remaining limbs appeared to be healthy. They bore green peaches and vigorous foliage.

May 13, 1889. Doubtful; a feeble shoot is pushing just beneath the stub of the excised limb.

September 17, 1889. The tree is diseased, but the symptoms are slight and confined to the trunk. There is a diseased shoot six inches below the excision, and another stouter one on the margin of the cut. The winter buds upon the latter are now germinating. The foliage of the entire top looks healthy and is vigorous for the time of year. Had these two shoots been removed prior to examination, or had they never grown, any one would have pronounced the tree entirely healthy.

October 11, 1890. Still diseased. Most of the foliage has fallen; what remains is abnormally reddish. Numerous winter buds are now germinating upon two shoots.

(13) August 10, 1888. Variety, Reeves' Favorite. One limb was removed; two limbs were left. The excised limb bore about a dozen large, ripe peaches and more than one hundred green ones. There were no diseased shoots; the foliage was full-grown and vigorous and the stump was sound. The remaining limbs bore healthy, green peaches and excellent foliage.

May 13, 1889. Apparently diseased, *i. e.*, there are a few feeble shoots on the trunk, but it is too early in the growing season to decide positively. One large limb was blown away by the tornado.

September 17, 1889. Still diseased. There are a few sickly shoots on the base of the trunk below the excision, but some robust, healthy-looking shoots also grow from the vicinity. Diseased shoots also grow from beneath the base of the limb which was blown away by the tornado. The crown of the tree still bears full-grown, dark-green foliage, but on one branch some of it curls and droops a little. There are no other signs of disease. No fruit this year.

October 11, 1890. The tree is well provided with good-looking foliage, but diseased sprouts have grown from the base of the trunk, and many winter buds are now germinating. No fruit.

(14) August 10, 1888. Variety, Oldmixon. Two limbs were removed, *i. e.*, about two thirds of the whole top; and two were left. One of the excised limbs was loaded with peaches which were ripe, and red-spotted on the skin and in the flesh. The other limb biparted one foot above the cut. The larger fork was loaded with ripe peaches; the smaller one bore many green peaches and only a few premature ones. This smaller fork had lost a branch and was dozy at the heart from that point downward for a distance of three feet, rain having entered. One stump was sound; the other showed two small dozy spots in the center, the result of the downward movement of the decay which began at the base of the broken branch. There were no diseased shoots and the foliage was healthy. The remaining limbs were healthy, *i. e.*, seemed to be. The peaches were green, and the foliage was excellent. I mention condition of stumps because yellows has been attributed to injuries. In this connection it may be noted that these trees were covered with smooth, sound bark and were very free from injuries of any sort on any part, limbs, trunk, or roots. The entire orchard has escaped the attacks of the borer (Ægeria) to a remarkable degree. Most of the trees used in this experiment were entirely free from them and had always been so while none of them had been seriously injured. Possibly the character of the soil has had something to do with this

† Upon the diseased trees in this orchard there were fewer yellows shoots in 1888 than in 1887. This was also true for all the other orchards in that region. It was correlated with dry weather, which also had its effect upon the total growth. At least, in this orchard, where I examined most particularly, the healthy terminal growths of 1888 were considerably shorter than those of 1887. There have been rather more cases, however, in the dry seasons than in the wet ones.

immunity. I find this insect most troublesome upon sandy or friable soils. On the light sands of Sussex and Caroline counties the borers have to be removed once a year and sometimes twice. Otherwise the orchards would soon be destroyed.

May 13, 1889. Apparently still diseased. The suspicious appearances are upon the trunk near where the limbs were removed.

September 17, 1889. Still diseased. Six inches below the lowest excision there is a feeble, much-branched yellows shoot. The smaller limb was blown away by the tornado. The remaining limb is now plainly diseased. Its spring foliage is full-grown, but lighter green than should be, and is somewhat inclined to droop and curl. There are also well-marked, feeble yellow shoots on several branches at distances of eight to ten feet from the excision. No fruit.

October 11, 1890. Most of the foliage has fallen; what remains is abnormally reddish. The tree is twiggy, and there are signs of disease in the top. One stem shoot also bears fifteen buds, which have germinated recently. No fruit this year.

(15) August 10, 1888. Variety, Christiana. Two limbs were removed, both from one side; one limb was left. Nearly all of the fruit on both of the excised limbs was premature; on both limbs three feet above the cut diseased shoots had pushed through the rough bark, but were only from one half inch to two inches long. On one of the limbs at the same height there were also stout, healthy-looking shoots of this season's growth. The other limb bore an additional fifteen or twenty feeble shoots five to eight feet above the cut. These were one or two inches long and had also developed from obscure buds buried in the bark or formed in the cambium. The stumps were sound and the spring foliage was healthy. The remaining limb bore green peaches and healthy foliage, but I had little hope of saving it, owing to the number of branches which manifested symptoms.

May 13, 1889. Apparently still diseased. A number of feeble shoots are pushing on the base of the limbs.

September 17, 1889. Still diseased. Half a dozen lusty shoots have grown from the base of the remaining limb, and three of these are much branched, feeble at the extremities, and badly diseased. The leaves upon the crown of the tree are of normal size and color, but are somewhat curled.

October 11, 1890. The spring foliage is of good size, but is unnaturally rolled and curled, reddish and yellowish-green and unhealthy looking. The winter buds are germinating upon four different shoots.

(16) August 10, 1888. Variety, Oldmixon. Two limbs were removed, both on one side. Each of the excised limbs bore a few high-colored, red-spotted peaches, and a much larger number of green ones. About four and a half feet above the cut one branch bore a few small unbranched, but diseased sprouts. There were no others on the tree. The stumps were sound. The remaining limbs bore many green peaches and excellent foliage. There was no trace of yellows.

May 13, 1889. Apparently still diseased. The suspicious shoots are on the base of the main limbs.

September 17, 1889. The tree is still diseased, and in all parts. Numerous, branched, feeble shoots have grown from the trunk and from the stubs of both excised limbs. These feeble shoots also occur on all of the larger branches and even in the top of the tree. The spring foliage is curled and yellow. This tree is much worse than any yet examined. No fruit this year.

October 11, 1890. Nineteen twentieths of the foliage has fallen; what remains is rolled, curled, and very red. The winter buds are now germinating on a dozen different shoots. No fruit in 1890.

(17) August 10, 1888. Variety, Reeves' Favorite. One limb was removed. This biparted 10 inches above the cut. The larger fork bore healthy, green peaches and the smaller one bore twenty to thirty ripe peaches, which, however, were confined to two small branches. There were no diseased shoots. The stump was sound and the foliage was luxuriant. The remaining limbs were loaded with green peaches and the foliage was like that of the excised limb.

May 13, 1889. The entire top was blown away by the tornado of August 21, 1888. Apparently, the stubs of the limbs are still diseased.

September 17, 1889. Branched, diseased growths now cover the whole upper part of the trunk. They have grown from the stubs of each limb, and also very abundantly from several places on the body below the excision. On the trunk they are very wiry and feeble.

October 11, 1890. This stub is trying hard to live. It now bears thrifty shoots, provided with an abundance of foliage of normal size and nearly natural color, which is now yellowing and nearly ready to fall. But it also bears a half dozen spindling, sickly branched shoots, and winter buds are now pushing on a number of others.

(18) August 10, 1888. Variety, Reeves' Favorite. One small limb was removed; two larger ones were left. The excised limb bore ripe and nearly ripe peaches on many branches and bore no green fruit. There were some small, diseased shoots well out upon one branc,hand a feeble shoot one fourth inch long had developed from an obscure bud and pushed through the bark only one inch above the cut. This was not discovered in time or the tree would have been rejected. The spring foliage was full grown, but in places in began to look yellowish. The stump was sound. The remainder of the tree was full of green peaches and healthy foliage.

May 13, 1889. Doubtful. A few feeble shoots are growing on the trunk below the stub of the excised limb, and on the base of another limb.

September 17, 1889. Symptons of yellows are now present. From the stub of the excised limb have grown two much-branched, feeble shoots upon which winter buds are now germinating. Such a shoot has grown also from the trunk, fourteen inches below the cut. There is also a small, diseased shoot on the base of a main limb, twelve inches above the excision. Otherwise the tree appears to be healthy. There was no fruit this year.

October 11, 1890. The foliage is abnormally reddish, and the winter buds are now germinating upon two large shoots, which have grown from the base of the main limbs. No fruit in 1890.

(19) August 10, 1888. Variety, Reeves' Favorite. One limb was removed. Two small branches bore ripe, red-spotted fruit. These branches joined the main limb about eight feet above the cut. Six other branches of about the same size bore green peaches. The entire limb bore full-grown, dark-green foliage; and there were no diseased shoots. The stump was sound. The remaining limbs bore healthy, green peaches and excellent foliage.

May 13, 1889. There are a few sprouts of uncertain character on the stub of the excised limb. Otherwise the tree appears to be healthy.

September 17, 1889. The top bears good foliage and looks healthy, but several branched and feeble diseased shoots have grown from the stub of the excised limb. There is no fruit, and I can find no certain indications of disease on any other part of the tree.

October 11, 1890. For the time of year there is more than the usual amount of foliage on this tree, and it is of better size and color, and less curled than on many of the trees. However, several terminal buds have pushed in the top of the tree, and winter buds are now germinating on six different shoots which have grown from the base of the main limbs. One of these shoots pushed twenty-eight buds in late summer or early fall. These made a spindling growth of two to four inches, and are now dead. On the same shoot sixteen additional buds are now germinating. There was no fruit in 1890.

(20) August 10, 1888. Variety, Oldmixon. One limb was removed; three limbs were left. The excised limb bore premature peaches on nearly every branch. One diseased shoot, one eighth inch long, was pushing through the bark about two feet above the cut, and a half dozen others, one eighth inch to one inch long, were visible higher up. There were no others, and the spring foliage was healthy. The remaining limbs were full of healthy foliage and green peaches, which Mr. Price said ought to ripen from nine to twelve days later.

May 13, 1889. Doubtful. There are some indications of disease near the stub of the excised limb.

September 17, 1889. The tree is now badly diseased. A half dozen rank-growing branched yellows shoots have pushed from the trunk below the excision and from the base of the limbs above it. Feeble yellows shoots are abundant on both main branches of one limb all the way to the ends of the twigs in the top of the tree, *i. e.*, twelve feet above the excision. The spring foliage on this limb is also dwarfed, curled and yellowish. On another limb the spring foliage is normal, but there is a diseased shoot at its base, and another about three feet up. The third limb appears to be entirely healthy. No fruit.

October 11, 1890. The foliage is very red and unhealthy-looking, and sickly shoots have grown not only in the top of the tree but also next to the roots and on the base of the limbs; and winter buds are now germinating. The tree bore no fruit this year.

This closes the excision experiments. The results varied considerably, but in no case did the removal of affected parts stop the progress of the disease. The symptoms appeared again the following season in all but two of the trees, and in these two they came back the second season.

Even when the entire top was removed, as by the tornado in G 17, the disease quickly reappeared.

The inference that the disease was really cut out and that all these cases are *reinfections* is inadmissible, because nothing of a similar nature occurred elsewhere in the orchards. To establish this we have only to trace the history of these trees for one year from the date of the excisions, and to compare that with the history for a similar period of other trees in each orchard, *i. e.*, those which were healthy when the excisions were made.

In Mr. GREEN'S orchard 100 per cent. of the excised trees showed fresh symptoms of the disease in 1888, but only about twelve per cent. of the others became affected; *i. e.*, the new cases in 1888 amounted to only twelve per cent. of the whole number of healthy trees. In Mr. HARPER'S orchard ninety-five per cent. of the excised trees showed fresh symptoms of the disease in 1889, but only about two per cent. of the others became affected. Most of the excisions were made in these two orchards, and no record of cases in the other orchards was kept for comparison.

In a few instances I have known fifty per cent. of the trees of an orchard to become affected with yellows in one year, but never one hundred per cent., and very rarely more than fifteen to twenty-five per cent., even in the worst affected districts. It would seem, therefore, that the disease persisted in these trees, *i. e.*, that the symptoms subsequent to the excisions were not the result of reinfection.

It remains to ask whether the excisions exerted any retarding influence. One year from the date of the excisions the trees in Mr. HARPER'S orchard were freer from symptoms of yellows than had been those in Mr. GREENE'S orchard (Experiment B), and the same relative difference was apparent at the end of the second year. It might not be proper, however, to draw the inference that the development of the disease was slower *on account of the excisions.* There is some doubt as to whether the excisions retarded the progress of the disease, for the following reasons: (1) The trees manifested only very slight symptoms to begin with, *i. e.*, much slighter than the trees in Mr. GREENE'S orchard; (2) they bore no fruit in 1889 or 1890, whereas the trees in Mr. GREENE'S orchard experienced the strain of a large crop in 1888, and of a partial one in 1889; (3) the natural progress of this disease is sometimes very slow, requiring a third season for the development of the symptoms in all parts of the tree. It is therefore not impossible that the disease might have progressed in these particular trees with the same slowness, had no limbs been removed. The most that can be said is that the severest excisions, *e. g.*, those in Mr. HARPER'S orchard, *appeared* to exert a retarding influence on the progress of the disease.

Of course, the results obtained do not preclude the *possibility* of cutting out the disease in some cases. The evidence to the contrary is, however, reasonably conclusive, and sufficient for all practical purposes. The experiments also throw considerable light upon the nature of the disease but do not settle the question as to whether the disease is latent in the *whole* tree when symptoms appear in any part of it. This will require additional experiments of another kind.

IV.—OBSERVATIONS AND EXPERIMENTS BEARING UPON IMMUNITY.

(1) The question of immunity is a very important one. If we could somewhere find peach trees hardy enough to resist this disease, a great practical problem would be solved. It has been said that seedlings are much less subject to yellows than budded trees. In the localities where

I have studied this disease seedling orchards are infrequent, but from what data I have been able to gather I should say that seedling trees derived from budded fruit are equally subject.

On the Delaware and Chesapeake peninsula the belief is also pretty general that budded trees imported into diseased districts from healthy localities are as much subject to yellows as those grown at home, or at least do not escape the disease. On the other hand, I have been told by growers that they have had little trouble from yellows since they have formed the practice of selecting their own buds and stocks. The well-known habit of certain nurserymen to buy trees wherever they can, and sell them again as their own stock, obscures what would otherwise be a somewhat simple problem. In many cases in studying orchards it has been difficult to determine the origin of the stocks, and impossible to learn anything about the location or character of the trees from which the buds were taken. Because nursery stock was grown in a locality free from yellows it by no means follows that the buds came from the same locality. Buds are often procured directly from a distance, or are taken from young trees recently introduced into a neighborhood. In case of new varieties, I have several times known trees to be propagated from young trees recently introduced from localities where this disease is very prevalent. In buying trees much depends upon the integrity of the nurseryman, which is often an unknown factor and sometimes a negative quantity.

The fact that growers in the diseased districts have bought trees from a good many nurserymen with pretty much the same results is tolerably strong evidence, although not entirely conclusive.

A knowledge of these facts led me to plan an experiment in which I should know in advance the character of the stocks and the buds, and be able to watch the behavior of the parent trees as well as the progeny so long as might be necessary.

(2) EXPERIMENT 1.—The trees for this series of inoculations were 1,000 Mariana plums rooted by J. W. KERR, at Denton, Maryland, in the spring of 1888 from cuttings made in his own orchards. They were divided into five lots and inoculated in August, 1888, with buds taken from five healthy peach trees also in Mr. KERR's own orchards. These five trees were carefully located and have been under observation ever since. I examined them particularly May 23, 1890, making the following memoranda:

The character of the trees from which came the buds used in working the peach on plum roots is as follows, all of the buds of one variety having been taken from one tree:

(1) *Oldmixon.*—Exact origin unknown; set out by T. A. Smith of Denton; age, 38 years; entirely free from yellows; a foliage of a healthy green.

(2) *Crawford's Early.*—Budded by Mr. Kerr from a bearing tree in Caroline county; set in 1874; entirely free from yellows; foliage vigorous.

(3) *Mountain Rose.*—Budded by Mr. Kerr from a bearing tree in Caroline county; set in 1876; entirely free from yellows; foliage vigorous.

(4) *Crawford's Late.*—Budded by Mr. Kerr from a bearing tree in Caroline county; set in 1876; entirely free from yellows; foliage vigorous.

(5) *Beers' Smock.*—Budded by Mr. Kerr from a bearing tree in Caroline county; set in 1876; entirely free from yellows; foliage vigorous.

These trees are old and broken, but they are not diseased.

The entire orchard was examined at that time. It contains about five hundred trees. They remind me of trees in the old orchards at Seaford, Delaware. Like them they suffered severely during the winter of 1881–'82,*

* The severity of that winter killed the dormant peach buds in Caroline county, Maryland,—a thing never known before or since. It also injured the wood of many limbs. The same injuries occured at Seaford, Delaware. However, at neither place did yellows supervene, and the belief that this disease is due to autumn frosts or severe winters is wholly untenable. There is not one fact offered in support of this view which may not be explained equally well in other ways.

and are rough, broken, shaggy with lichens, and frequently two thirds dead. Here and there a tree is missing. Others have lost their entire top, healthy growths from the trunk having partially taken its place. The foliage on all was green and thrifty. There were no cases of yellows and no suspicious trees. All of the younger orchards on the same farm were likewise examined with a similar result.

This experiment is the only one in which I did not superintend the inoculations personally. At that time other duties engaged my attention, and having entire confidence in Mr. KERR, I trusted it entirely to him, being assured that all the details would recieve his personal attention.

Yellows has never appeared in any orchard on his farm, or in any on the adjoining farms; was not reported from Caroline county until 1887, is still rare in that county; and is not certainly known to occur anywhere in the immediate vicinity of Denton. If cases do exist at Denton, they must be sporadic and rare. Otherwise I must have seen them or heard of them. Such being the conditions, I could at the date of these inoculations think of no place where one would be more likely to secure buds free from any taint of yellows.

A hailstorm in June, 1889, destroyed the tops of many of these trees. The remainder were removed from the nursery in November of that year, and were planted in three badly affected orchards further up the peninsula.

(*a*) The trees which went to JAMES W. GREEN, Magnolia, Delaware, were set in the southwest corner of an orchard on his home farm. Yellows appeared in this orchard in 1886 and has been very destructive, more than fifty per cent. of the trees having become affected. The disease is also very prevalent in neighboring orchards, including a younger one on the same farm. The spot selected was specially adapted to the experiment, because the disease first appeared in that part of the orchard, and speedily involved many trees. In 1889 this corner of the orchard contained very few healthy trees, but none had been dug out, and none were entirely dead. The diseased trees were removed in March, 1890, and the land then received a heavy dressing of barnyard manure, *i. e.*, over 100 loads. The young trees, which had been trenched in over winter, were then set in the spots previously occupied by the affected trees, each being given a handful of phosphate. One hundred and thirty-six trees were sent to Mr. GREEN (ninety-four Beers' Smock and fourty-two Oldmixon), but only 124 were set. Some were quite small, but all were healthy. The Smock trees were planted next the highway.

These trees were under observation from time to time during the growing season and were critically examined September 18, 1890. Only forty-seven had made a satisfactory growth. Of the remainder, twenty-four were dead and fifty-three were dwarfed and yellowish as though suffering from defective nutrition. None, however, showed any signs of yellows. These trees received good cultivation, were not shaded, and did not appear to be suffering from root aphides. They had been set very deep, and I was at a loss to account for the appearance of the sickly ones, unless this might have to do with it. Later, I discovered that in all of the dwarfed and yellowish trees the tops had overgrown the stocks, and that in all the vigorous trees the growth of the stocks had kept even pace with that of the tops. The dead trees were killed in spring by the black peach aphis, which sapped and smothered the tender shoots.

(*b*) The trees which went to F. H. HARPER, Still Pond, Maryland, were planted in the east end of one of his orchards on the Howard farm, in

places made vacant by the removal of diseased trees. This orchard also appeared to be a good place to try the resisting power of healthy trees. Yellows first developed in 1886 and is still present, the cases having amounted to over twenty-five per cent. of all the trees. The disease is also very prevalent in other orchards in the vicinity, including a younger one on the same farm.

Mr. HARPER received 125 trees—fifty Mountain Rose and seventy-five Crawford's Late. All were healthy, of medium size, and in good condition for planting. Part of them were set in November and the remainder in early spring. In some cases the diseased trees were removed just previous to this planting; in others, they had been out for a year or two. The peach upon plum were not set in a body, but were scattered among the large trees.

I saw them the last of May, 1890, at which date they looked more promising than either of the other plantations. They were reëxamined October 11, 1890, but many were choked and overgrown by weeds so as to be scarcely visible. Part of them had also been injuriously shaded by the older trees. Some were dead and very few had made a satisfactory growth, but none were suffering from yellows. Their bad appearance was attributable in part to neglect. Young trees set into older orchards require special care.

(*c*) The remainder of the trees—seventy-five Mountain Rose, one hundred Crawford's Late, and one hundred and seven Crawford's Early—were set on Dr. W. S. MAXWELL'S farm, at the mouth of Sassafras river, Kent county, Maryland. The two acres selected for this orchard are on a level hilltop, overlooking orchards No. 1 and No. 18 of my first report. This field seemed very well adapted to the experiment, having been already once in orchard and being in the center of a region of diseased orchards. The remnants of the first orchards, about seventy-five trees in all stages of yellows, were removed in the spring of 1890. They were then 9 years old, *i. e.*, set nine years, and were the last to become affected. The rest of the trees had succumbed earlier and were dug out at various times, most of them in 1888. The trees had grown vigorously and were large.

The peaches on plum roots were received November 7, and were set the same day, midway between the places occupied by the old trees. Three fourths of these trees were very fine; the rest were small. They were set shallow with a view to lessening the attacks of borers.

About one pound of unleached, hardwood ashes was distributed around each tree at planting, and tomatoes with phosphate were grown in the field in the summer of 1890.

The black peach aphis appeared upon the tops of these trees in early spring and destroyed many of them. The remainder were seen as late as the last of May and then promised well.

These trees were reëxamined October 8, 1890. At that time eighty-eight were dead, mostly from the attacks of the black aphis. Of the remainder, forty-two were stunted and yellowish like similar trees in Mr. GREENE'S orchard, while one hundred and fifty-two were very thrifty and still bore dark-green foliage, In the former, in every case, the peach top had overgrown the plum stock, producing a distinct bulge. In the latter the stocks had kept even pace with the growth of the tops, and the abundant foliage was still vigorous. In fact, I have seldom seen finer yearling trees. None of these trees showed any signs of yellows.

The five trees which furnished the buds were reëxamined very carefully

July 22, 1891, *i. e.*, 3 years from the beginning of the experiment. They were still entirely free from yellows, or any symptoms suggestive of that disease, and were more vigorous than in 1890, owing to the turning under of a crop of scarlet clover.

Of course, it is impossible to predict the results of this experiment. We must wait and see. I shall continue to watch the parent trees as well as their progeny. I feel reasonably confident that trees with sound constitutions have been secured, and I know beyond a doubt that they are in excellent locations to test their resisting power.

(3) A twice-repeated effort to introduce a sound race of peaches from Turkestan has miscarried. It seemed like an easy matter to procure peach stones in quantity through our consul at Teheran, but it has proved very difficult. The second attempt was made in 1889 through the department of state, but with no better results.

It appears to me safer to import stones than trees. If the latter are introduced, great care should be exercised to avoid the introduction at the same time of animal and vegetable parasites which might prove worse than yellows. The history of the introduction of the cottony cushion scale into the orange groves of California, and of phylloxera, peronospora, and black rot into the vineyards of Europe ought to be sufficient warning. The danger is a very real one.

In Mediterranean countries and also in Australasia there is a fruit fly (*Tephritis*) which once introduced into this country would work great mischief. It deposits its eggs in the fruit after it is nearly full grown, and these hatch into swarms of maggots, which pupate in the ground. Externally the fruit is said to be fair, but within it is disgusting corruption. The peach is specially subject to this fly, but apples, pears, plums, and other fruits are also attacked. The loss is great and no remedy is known. In Japan there is a codlin moth which is said to affect ninety per cent. of the ripe fruit. This insect probably occurs also in China. In the Australasian region there is also a very destructive root fungus, not confined to the peach. The mycelium of this fungus creeps through the soil long distances destroying almost every green thing in its path. There is also an obscure peach disease fully as destructive as yellows and apparently of a totally different character. The orchards of the north island of New Zealand have been almost completely destroyed by it, and it probably occurs elsewhere in that region.

This enumeration by no means exhausts the list of parasites which might be introduced into this country with imported peach trees. As the case stands we have enough of our own without importing any.

(4) Additional experiments will be necessary to determine what proportion of cases are attributable to the careless selection of buds. Yellows is undoubtedly communicated in this way, but it must spread in other ways. I have known many orchards of budded fruit where the trees flourished and bore abundantly for fifteen or twenty years, or even longer, before the disease appeared. In such cases, admitting the contagious nature of the disease, we are driven to one of two conclusions: the cause of the disease has entered the tree from without, or has been dormant in it from the time it was budded. The former is reasonable; the latter is absurd, especially in the light of the comparatively speedy results obtained from inoculations.

One of the most striking examples which has come under observation is a tree on the home farm of James S. Harris, near Still Pond, Maryland.

Since one case in point is as good as many, I have been at some pains to learn the history of this tree. This tree is 36 years old It is one of a number of accidental seedlings which came up from stones thrown out in the fall of 1854. It then stood back of an old shop. This was afterward removed and other changes made so that for quite a good many years the tree has stood in sod ground, in the lawn, somewhat isolated from other peach trees. It was budded by Mr. HARRIS himself in the fall of 1855, and has been under his observation and care ever since, with exception only of a few years when he did not reside on this farm. The variety is Crawford's Early. The tree has been hardy and productive. Its last crop was in 1888, since when, in common with other trees in that region and owing solely to unfavorable seasons, it has borne no fruit. The tree is about twenty-five feet high and has a good top; the trunk is nearly a foot in diameter and still quite well preserved. I have seen this tree each year since 1887, and always it seemed to me good for another ten years. This tree was budded from a neighboring tree when there was no yellows in the vicinity. Some years after, perhaps ten, the disease appeared and gradually destroyed many younger trees upon the same farm, one of the badly affected orchards being within a stone's throw of this tree. The disease has increased from that time to this, and has been very destructive for the last five or six years in all that region. This old tree, however, kept on the even tenor of its vigor until the summer of 1890. Then for the first time it developed unmistakable symptoms of yellows on one small limb. Next year, undoubtedly, the disease will be manifest on other limbs if it does not involve the whole tree.*

Admitting the contagious nature of yellows, and this, I think, can be doubted no longer, I am at a loss to explain the appearance of the disease in middle-age and old trees except by infection from without. If such be the case, then, of course, every tree which becomes affected is a fresh source of danger, and ought to be removed and destroyed as soon as possible.

V. CONCLUSIONS.

The intelligent reader will draw his own conclusions. It is not out of place, however, for me to present my view of the case. This is as follows:

Facts Established.

(1) The disease is contagious. It seems to me that Experiments 1, 2, and 5 settle this point beyond dispute.

(2) It may be conveyed by seemingly healthy buds when these are taken from diseased trees. This is proved by Experiments 2 and 5.

(3) Only a very small amount of infective material is necessary, provided it be in the forms of living cells, which can be induced to unite with the actively growing tissues of the tree.

(4) The disease has a longer period of incubation than we have been accustomed to suppose. (See Experiment 2, especially Table I, columns 5 and 6. See also the Excisions, especially B 16, 18; E 3; G 3, 4, 5, 6, 12, 19; and the note under G 3.)

(5) The death of the entire tree occurs, ordinarily, only after a very considerable period, *i. e.*, several years.

*Examined July 21, 1891. The disesased limb and the adjoining healthy one have been removed and the remainder of the tree shows no symptoms. The tree bears green peaches.

Hypothesis Rendered Probable.

(1) The whole tree is affected when symptoms appear in any part of it. This inference rests upon Experiment 2; a small part of Experiments 4 (?) and 5; and almost all of the excisions, fifty-two in number. It is hoped that experiments now under way will settle this point definitely.

(2) In some cases, perhaps in many, the period of incubation, *i. e.*, the time between the insertion of a diseased bud and the appearance of the disease, is longer than any yet clearly established. This is suggested by many things, especially by the behavior of some of the Barnard trees (Experiment 4); by the Excisions E 3, G 3, and the WILSON tree; and by Professor GOFF'S tree.

(3) The disease is also communicated to budded trees in some other way than by bud inoculation. This is probable in case of many young trees, and is almost certain in case of old trees. In some of my experiments the period of incubation was very considerable, and this is one of the striking peculiarities of yellows, but it is too brief to account for the appearance of the disease after the second or third year, except possibly in case of some of the trees budded at Colonel BARNARD'S. The evidence in favor of outside infection becomes stronger in proportion as a tree gets older. Of course, it goes without saying that additional experiments may demonstrate the period of incubation in some cases, and perhaps in many, to be much longer than any yet established.

(4) The trees are not infected through the blossoms. This is inferred from the result of the excisions, and from the fact that, in some cases, the disease appears to develop between fall and spring, and to stimulate the blossoms themselves to an unnaturally early development. About fifty cases of this kind came under observation during the very mild winter of 1889–'90, and many additional ones in the spring of 1891.

(5) Since diseased trees have been shown to be very full of infectious matter it must be that for unknown reasons much of this fails to find an immediate entrance into healthy trees. Otherwise the peach would soon disappear entirely.

Inquiries Suggested by the Foregoing Experiments.

Three special lines of inquiry are now under consideration, and will receive undivided attention as soon as the laborious experiments with fertilizers have been completed. These are as follows:

(1) The period of incubation of the disease prior to its first appearance, *i. e.*, the greatest length of time a tree may be affected before it shows any symptoms of yellows.

(2) The exact nature of the contagium.

(3) Its method of spread other than by bud inoculation.

PART II.—PEACH ROSETTE.

I. INTRODUCTORY.

The second part of this report will be devoted to a peculiar disease prevalent in Georgia, and first referred to as probably a southern variety of peach yellows,* but since described under the name of *The Peach Rosette*.†

* Peach Yellows: A preliminary Report, U. S. Dep. Ag. 1888.
† The Journal of Mycology, Vol. 6, No. IV.

The disease does not appear to be due to any ordinary fungus, or to insects. In some respects it is quite like peach yellows, but in others it differs very materially. This year additional observations have confirmed the belief that it is a disease distinct from yellows, and I shall so consider it until proof to the contrary is forthcoming.

(1) *Plants attacked.*—As stated elsewhere, rosette attacks many varieties of peach. None appear to be exempt. It occurs in budded fruit and seedlings. The latter do not escape even when growing in fields and thickets without cultivation. This disease is not confined, however, to the peach, but also occurs in plums—budded trees and seedlings, cultivated, uncultivated and wild, and is equally destructive. I have not seen it in varieties of *Prunus domestica* or in the Mariana, but it occurs in the wild *Prunus Chicasa*, in the Cumberland, and Wild Goose, and also in the Japanese varieties known as Kelsey and Botan. Probably the disease is capable of attacking many other sorts, and requires only a suitable opportunity.

This year in an orchard near Griffin, Georgia, which I know to have been nearly free from disease in 1890, and quite thrifty and well cared for, I counted about forty bad cases of rosette, divided nearly equally between Kelsey and Botan. These trees were five or six years old, and the loss must have been considerable.

(2) *Characteristics of the disease.*—As in peach yellows, this disease not infrequently attacks one or two branches only, at first, but in a much larger per cent. of cases, the whole tree is diseased from the start, and the disease runs its course in a much shorter time. Six months is usually sufficient to destroy a tree, and I have known no cases to last more than two seasons. Such a thing as the lingering on of a diseased tree from year to year, as in peach yellows, is not known. I have seen trees completely diseased in June and dead in November, which first showed symptoms in early spring and were in apparently perfect health the preceding autumn. This is the common course of the disease.

When a tree is attacked in part, the shoot-axes and foliage of the remaining limbs often appear to be perfectly healthy, but these limbs always develop rosettes, and die the following year. Not infrequently I have observed the disease to progress gradually from the affected side to the healthy, *i. e.*, the parts on the healthy side first to be attacked being the bases of the limbs. The bark of trunk and limbs on affected trees presents no peculiar or symptomatic differences. Undoubtedly there are changes in the cambium cylinder corresponding to the shortening of the terminal shoot-axes, but these are not visible externally.

The following are some of the most noticeable symptoms:

(*a*) *Young shoot-axes.*—Commonly the disease first appears in the unfolding shoot-axes, *i. e.*, in early spring when the buds first open. In healthy trees only a small proportion of the winter buds develop into branches, the rest die or remain dormant. In this disease a very large part of the winter buds grow into shoot-axes and also a very considerable number of dormant buds on the older and larger branches. The shoot-axes in healthy trees, especially the terminal ones, generally attain a growth of six to twenty inches and develop ten to twenty vigorous leaves with dormant blossom and foliage buds in their axils. As the season advances such shoots ripen their wood, cast their foliage, and remain quiescent until spring invites the opening of their buds and the renewal of vegetative activity. In diseased trees, the shoot-axes push only one to three inches,

lose, almost completely, the ability to develop and ripen wood, and to form dormant buds. The buds on such shoots grow as soon as they are formed, or rather, as soon as they receive the initial differentiation, developing into diminutive soft branches, which frequently branch again, but never attain any good degree of size, vigor, or maturity. It is ordinary to find fifteen to thirty primary branches and often some additional secondary ones, on a shoot-axis less than three inches long, and not over one eighth inch in diameter at its base. The tendency of this effort of branching is from below upward, *i. e.*, the oldest and largest branches are near the base of the shoot, but almost always not quite from the base, the buds remaining undeveloped in some of the lowest leaf axils.

(*b*) *The foliage.*—The leaves on these dwarfed branching shoot-axes are multiplied correspondingly, and the result is compact tufts or rosettes containing 200 to 400 diminutive leaves, and many additional green stipules which are frequently misshapen and abnormal. The older and larger leaves near the base of the shoot frequently reach a length of several inches and are characterized by a very pronounced inrolling of the margins of the leaf, and by a certain stiffness due to a peculiar straightening of the midrib. These leaves turn yellow in early summer and fall very readily. Jarring causes them to fall by the hundred, as if it were autumn. Very often they are blotched, browned, and dead in places, especially at the ends and margins, from the attacks of various leaf fungi. The younger and central leaves of the rosette remain small and green and free from fungi. They are usually somewhat folded, but seldom rolled. As summer advances these rosettes dry up and die under the attacks of *Scolytus rugulosus* or from the effects of the disease. The foliage of some affected trees is much greener than others. Generally the prevailing color from a distance is yellowish green or olivaceous. The bunching of the leaves is conspicuous and makes the trees noticeable at a long distance. There is not enough foliage to give shade or hide the branches.

(*c*) *Flowers and fruits.*—So far as I can determine by inquiry, the trees which developed this disease in 1891 in Mr. HUSTED's orchards did not blossom in advance of other trees, but were somewhat tardy. On the contrary, other trees in the same orchard, imported from New Jersey and affected with an entirely different disease, and what appears to be genuine yellows, blossomed ten days in advance of the proper time.

Trees attacked by rosette generally drop their fruit early and while it is still green or yellowish green. In June, 1891, I saw scattering fruits on many diseased trees, and none of them were premature or bore any of the characteristic symptoms of peach yellows. The fruit, even on badly affected limbs, when there was any at all, was small, green, or yellowish green, and often more or less shriveled. Fruits of this kind were also common on the ground under such trees. In one instance the disease was observed in Alexanders which were full of ripening fruit and affected by the rosette only on about one half of the limbs. Most of the fruit had already fallen from the diseased limbs, green and shriveled, but a few peaches remained on the healthier portions, and these, like those on the other limbs, were neither premature nor red-spotted, but were ripening at the proper time and in the normal manner. The diseased branches bore hundreds of yellowish rosettes; the healthy ones bore an abundance of dark green, handsome foliage.

My search for premature fruit was the more careful because I had ventured the assertion that it would, no doubt, be found to precede the rosette.

In one or two instances only, I heard of premature peaches, but on examination they were clearly attributable to borers and not the sort produced by yellows. In one orchard where the borers had been left undisturbed for several years, I saw fruits prematuring on many trees, but there were no symptoms of yellows. The color and flavor of these fruits was natural and they were ripening only a week or ten days in advance of the proper time.

(*d*) *Roots and rootlets.*—Superficially the roots appear to be normal, but the rootlets are dead and shriveled as in peach yellows.

(*e*) *Gummosis.*—The green and shriveling fruits from rosetted limbs were full of minute gum-pockets, but this symptom was afterward observed quite frequently in imperfect fruits taken from healthy trees. The "June drop" from Elberta trees was very copious at Griffin, Georgia, in 1891, and most of these fruits were smooth externally but gummy within, the entire seed-cavity being changed into a gum-pocket in many cases. These fruits were an inch by inch and a half in diameter at time of dropping.

Many of the roots of rosetted trees were honeycombed by gum-pockets (June, 1891). This symptom was found to be nearly constant; *i. e.*, it occurred on some roots of nearly every affected tree. But it was also observed to a slight extent on the roots of two trees which stand very near diseased ones, but which have not yet developed any symptoms of the rosette. Many of the roots were so gummy as to feel sticky when bruised. By making a clean cut at right angles to the main axis of the root the gum-pockets were frequently visible without the aid of a triplet, especially when the oozing of gum was copious. These pockets were confined generally to the outer part of the wood cylinder, and in several cases, known to have been healthy in November, 1890, the cylinder of gum-cavities was confined to the wood laid down in 1891, or to the dividing line between this wood cylinder and the next inner one, and did not extend into the wood formed in 1890.

These closed gum-pockets involve few to many wood fibers, and frequently include the very resistant cells of the medullary rays. On cross-section they appear like an interrupted ring, or like a necklace of triangular beads, in which each member corresponds to a pocket. The base of these triangular cavities was always nearest the pith. Occasionally two cylinders of gum-pockets were observed, one in wood formed early this spring when the disease first appeared in the trees and the other formed in wood recently laid down. In a few cases they occured also in the bark. The walls were brownish and irregular, with modified and frequently hypertrophied and projecting cells. These cavities appeared to be free from mycelium and bacteria, and cultures from the walls and the exuding gum gave no positive results.

The roots of about fifty trees were examined for this symptom, but lack of time prevented the examinations from being as extensive and complete as desirable.

(3) *First appearance and present distribution.*—So far as I can learn by diligent inquiry this disease first appeared in Georgia about 10 years ago. It may have existed longer, but satisfactory evidence of this is wanting. It occurs in the middle and north part of Georgia quite generally, but I have not observed it in South Georgia or in Florida, nor in South Carolina or states to the north.

This disease, or one very much like it, also occurs in Kansas. It appeared at Manhattan in 1889, and is now quite prevalent in that locality but has not been reported from other parts of that state.

The disease is very destructive in both states. Mr. T. C. Wells of Manhattan, Kansas, lost his entire orchard in two years. Mr. R. C. Fryer of Shiloh, Georgia, has lost several orchards, each in a space of about three years. In other parts of Georgia the disease has progressed less rapidly, but no less surely. About Griffin, Georgia, the seedling-peach orchards, and the wild plums have suffered most, but the disease has been in the budded orchards for some time, and is gaining ground every year. Next to peach yellows, I regard it as the most dangerous enemy to peach culture in the United States. In some respects it is worse than yellows, because it runs its course more speedily and is more apt to take the entire tree from the start. Should it become as prevalent in Kansas and Georgia as yellows now is in north Maryland and Delaware, profitable peach-growing will be entirely out of the question.

II. INOCULATIONS.

Experiment 1.—One hundred and twenty-five trees were selected for this series of inoculations. They were grown in 1889 by J. D. Husted, Vineyard, Georgia, and formed part of a nursery of several thousand seedlings which were not budded that year, but were cut to the ground in the spring of 1890, so as to be suitable for budding the following summer. All of them appeared to be healthy and the shoots of the season were vigorous and in good condition for inoculation. The trees selected were the outer five rows in the southeast corner, and were not different in appearance from the rest of the nursery.

The buds for inoculation came from several five-year-old trees in an orchard on the same farm. These trees were badly diseased in all parts, but were vigorous and free from any sign of disease in 1889. They were dug out and burned soon after the buds were taken, but, judging from the rapid progress of the disease in other trees similarly affected, they would not have lived through the growing season. It was impossible to find dormant buds, so I selected the base of such diseased shoots or rosettes as had pushed only a little way, removing from them all of the foliage. They were cut June 21, 1890, and inserted the same day, two into each tree, in the customary way. The inoculation was skillfully performed, and an examination two weeks later showed that nearly all of the buds had healed on satisfactorily and were alive. As in Part 1, Experiment 2, the tops of the seedlings were purposely allowed to remain.

Some of these trees began to show signs of disease in August, *i. e.*, within two months, but they were not examined until November 3, *i. e.*, four months and twelve days from the date of inoculation. Then a careful examination revealed the following conditions: Of the 125 seedlings which were inoculated, fifty-seven were healthy, sixty-six were diseased, and two appeared to be dead.

In six of the fifty-seven healthy, one or both of the inserted buds had pushed into diseased growths; in the rest, the buds had made no growth (the majority), or only a slight growth of uncertain character. In most cases the bark inserted with the buds was still living.

Sixty-six of the stocks had the same disease as the trees from which the buds were cut. The diseased shoots pushed out indifferently above or below the inserted buds, or from both places. These stocks might have been grouped into four classes according to the severity of the symptons: (1) Doubtful, 4; (2) very slight symptoms readily overlooked, 20; (3)

worse affected than No. 2, but also not likely to attract casual attention, 36; (4) bad cases which no one could overlook, 6. Some of these growths were as much as six inches from the nearest inserted bud. In thirty-nine of these trees the inserted buds did not grow, or grew only slightly, the bark which was inserted with them being yet alive. In twenty-seven, one or both of the buds had grown into diseased shoots. All but one of the six bad cases fell into the second category. The character of these growths was much like yellows, except that the shoot-axes were greatly reduced, making them much more tufted. The winter buds pushed in the same way—prematurely.

The remainder of this nursery was used for comparison, but a careful examination of many trees brought to light no traces of this disease. The orchards on the same farm might also have served for control. This disease occurs throughout the surrounding country, but is not what might be called epidemic. The farm contains about 100 acres of peach orchard of various ages. The disease first appeared on it in 1887, and the number of cases each year has been as follows: 1887, 2; 1888, 5; 1889, 13; 1890, 31; 1891, 47. This year, in which more cases developed than any previous year, they numbered only about one third of 1 per cent. In the nearest orchards on other farms the per cent. of loss has also been slight.

This experiment attracted some local attention, and the trees which furnished the photographs were shown to many persons at a meeting of the Middle Georgia Horticultural society, November 6, 1890.

The rapid progress of the disease was surprising. Over one half of the stocks became affected *in less than five months*, whereas results were not expected until 1891, if at all.

These trees were re-examined June 3–6, 1891, at the urgent request of Mr. Husted, who desired to get rid of them. The results surprised and delighted me beyond expectation. The diseased trees were distinguishable at a great distance, and at first glance it looked as though every part of every tree was affected. The actual conditions were as follows:

(1) Four trees were entirely free from disease and had made an excellent growth, their average height being about four feet.

(2) Two trees were badly diseased, but a few small branches had developed normal, or nearly normal, leaves and shoot-axes, while a few others bore sickly yellowish leaves and no rosettes. These trees were dwarfed, and at least nineteen twentieths of the branches bore yellowish green rosettes.

(3) The remaining trees, 113 in number, were diseased in all parts, exactly as had been the trees from which the buds were taken. The leaves and shoot-axes were stunted, yellowish green, and bunched into striking rosettes. Out of this large number of trees there was not one which bore a single healthy leaf or a normally-developed shoot-axis. Every part of each tree was completely diseased. The greater number were still alive in all parts, but a few were withering and a few were already dead. Almost all of the winter buds developed into rosettes in spring, and in some cases these appeared also on the stems above and below the location of the inserted buds.

A more satisfactory outcome could scarcely be desired for any experiment whatsoever.

Each tree was carefully examined, and notes were made on the condition of each inserted bud. These observations were also verified, at my request, by Mr. W. T. Swingle of the Division of Vegetable Pathology, so as to leave no doubt whatever concerning their value.

In the four trees which remained healthy the inserted buds failed to unite with the stocks and were thrown off, the bark of the stock having healed over under them. The only uncertainty was concerning a small fragment of the bark of one bud, and the evidence of union in this case

was so unsatisfactory that it was entered as "very doubtful." Three of these trees received two buds each, but by accident the other received only one bud.

In one of the 115 diseased trees the evidence of union between the stock and the two inserted buds was also doubtful. In all of the others some part of one or both buds had united with the stock, and in many instances was still living. This was also true of the six trees removed in 1890. Often, however, only small fragments of each bud healed on. Occasionally less than one fourth of one square centimeter of the bark of one bud was all of the diseased tissue that had actually united with the stock, and yet this was sufficient to induce the disease. None of the inserted buds pushed over three inches, most failed entirely or pushed one fourth inch to one inch and then died.

The diseased seedlings were noticeably smaller than the four healthy ones. On an average they were about three feet high with a proportionate spread of branches.

The contrast between the November and June examinations is noteworthy. In November, when the disease had been acting less than five months, only sixty-six of the stocks showed any symptoms whatever. None of them were wholly diseased; most showed no signs of disease at a distance, and even a large part of the six worst cases was still free from symptoms. In June, after the disease had been acting nearly a year, 121 of the original 125 trees had become affected, and 115 so completely that it was almost impossible to find any healthy branches. The only uncertainty is concerning the six which were removed in November for photographic purposes. Their condition, however, at that time warrants one in believing that they too would have become wholly diseased long before June.

This experiment was the more striking, because in the same field, forming part of the same nursery, and separated from these five rows only by the width of a one-horse cultivator, are about 4,000 Elberta trees, which were budded on the same stocks and at about the same date with buds cut from healthy trees on the same farm. These trees were carefully examined for the rosette, but in the whole nursery there was not one case, nor even one suspicious tree. The line of separation between these healthy trees and the five inoculated rows was sharp as could be desired, and the contrast was most astonishing.

Naturally, the results of this experiment attracted considerable attention in Georgia, especially the appearance in the spring and summer of 1891. The trees were examined by many persons, including Col. R. J. REDDING, director of the Georgia Experiment Station; GUSTAVE SPETH, Horticulturist of the Georgia Experiment Station; Prof. J. E. WILLET of Macon; H. W. HASSELKUS of Griffin, and RUDOLPH ŒTTER, of Vineyard. A summary of the final results was given before a meeting of the Middle Georgia Horticultural society, June 9, 1891. The matter was also brought to the attention of Mr. BERCKMANS and other members of the State Horticultural society.

Experiment 2.—This was also performed at Vineyard, Georgia, on the farm of J. D. HUSTED.

The fifty-six trees selected for this series of inoculations were vigorous, well-rooted cuttings of the Mariana plum. They formed part of a small nursery grown in 1889, but not budded that year, being cut to the ground in the spring of 1890, so as to secure fresh shoots for budding the follow-

ing summer. These trees formed the east end of the south row and were not different in appearance from the rest. All were the picture of health.

The buds for inoculation were taken from the north side of a seedling peach tree which was growing by the wayside near Pomona, Georgia. This tree may have been four years old. The south one half of it was diseased by the rosette, and the remainder appeared to be healthy. Well-matured *terminal shoots* from the healthy-looking branches were selected for use in budding. All of them bore full-grown leaves of a healthy green, and their buds showed no tendency to germinate. Moreover, all of the foliage on the branches in the immediate vicinity was full-grown and healthy, and there were no signs of disease nearer than the base of the main branches, four to six feet below. The buds were cut July 1, 1890, and inserted the same day—two into each tree—in the usual way. A subsequent examination showed that many of them had healed on and were living. The tops of the cuttings were not removed until some weeks later.

These trees were reëxamined November 3, 1890. At that time only thirty-two of the fifty-six stocks bore peach shoots. Upon the rest the buds failed to take or died soon after commencing to grow. In thirty of the stocks the buds had grown into shoots, which were fifteen to thirty inches long. In many cases both buds grew. The foliage, which had not yet fallen, was normal except for slight parasitism of *Puccinia pruni*, Pers., and the shoots were vigorous. There were no rosettes, no winter buds were germinating, nor were there any other signs of the disease. One bud only developed in each of the other two. One had grown only about eight inches, but was normal; the other had grown only a half inch and the foliage was reddish and unhealthy. All of the stocks appeared to be as healthy as when the buds were inserted.

The parent tree was also examined at this time. The disease had made considerable progress, but careful search failed to discover any germinating buds or sickly shoots upon that part of the tree which supplied the buds for inoculation. There were signs of disease at the union of the main limb and the stem, but none further up. All large parts of the tree were still alive.

This tree was reëxamined June 8, 1891. It bore no normal leaves or shoot-axes. The limbs which were first to manifest disease in 1890 were now dead in great part, and all other portions of the tree were badly diseased, including the branches from which the buds were taken. Unfortunately the extreme ends of the branches were dead without symptoms of rosette or foliage of any sort, but they were living last November and are now alive to within one foot of the cuts, and bear very sickly rosettes.

The peach tops inoculated upon the Mariana plums were again examined June 22, 1891, and the contrast between them and the condition of the tree which furnished the buds was very great. They looked as healthy and vigorous as did the north side of the parent tree when the buds were cut.

Fifteen stocks bore double shoots and sixteen bore single shoots, making a total of forty-six living peach shoots on thirty-one stocks. A very few of the remaining Mariana stocks died; the rest grew thriftily and were cut back to the earth at the time of this examination. None developed any symptoms of rosette. The average growth of the peach shoots to date is three to three and a half feet, and their diameter at the base where they

join the plum is three eighths to six eighths of an inch. They show no symptoms of rosette or decline, while the parent tree is now affected in all parts and already half dead.

In another way this experiment establishes the same fact as No. 1, *i. e*, *the gradual transmission* of a germ or virus of some sort from diseased to healthy parts. Clearly something is now affecting the tissues of the north part of the parent tree which was not in them one year ago. Otherwise the forty-six peach shoots should now be diseased exactly like that part of the parent tree.

It is obvious that some years must elapse before this experiment is complete, but enough has been observed already to make it almost certain that the disease was not communicated by these buds. It is the same kind of experiment as No. 4 of Part I.

III. CONCLUSIONS.

(1) The rosette, as now understood, differs from peach yellows in the following particulars:

(*a*) The more tufted character and somewhat different appearance of the diseased growths.
(*b*) The much greater tendency of these compactly tufted growths to develop in early spring from winter buds and to appear all over the tree.
(*c*) A less tendency to develop sprouts upon the trunk and main limbs.
(*d*) The absence of premature fruit.
(*e*) The general early fall of leaves and fruit on affected trees, the fruit being small, yellowish green, and more or less shriveled and gummy.
(*f*) Gummosis of the roots.
(*g*) The occurrence of the disease in plums.
(*h*) The much more speedy destruction of affected trees.

(2) The disease is virulently contagious (Experiment 1), and it is probable that something might be done toward checking its increase by the prompt destruction of all affected trees. This should be done in early spring, as soon as the disease appears and before the leaves begin to fall.

(3) The disease may exist for a short time in part of a tree without being in the rest of it (Experiment 2), but it soon involves the entire tree. In other words, it would seem from Experiment 2 that the cause of the disease must enter the tree at some particular point or points and be carried gradually to all parts through the circulation. A comparison of the November and June examinations in Experiment 1 also confirms this belief.

(4) As in peach yellows, the admitted fact that neighboring trees are not always the next to take the disease is no argument against its communicable nature.

(5) This disease has gained a strong foothold and is on the increase, especially in that part of Georgia known geoglogically as the Archæan.

(6) If Georgia peach-growers would save their orchards and maintain the successful cultivation of the peach, the necessity for prompt and concerted action appears to be very great.

INDEX TO PROF. SMITH'S PAPER ON YELLOWS AND ROSETTE.

BULLETINS.

I. MICHIGAN AGRICULTURAL EXPERIMENT STATION.

II. NEW YORK AGRICULTURAL EXPERIMENT STATION.

III. U. S. DEPARTMENT OF AGRICULTURE.

IV. U. S. CENSUS—HORTICULTURE.

MICHIGAN EXPERIMENT STATION BULLETINS.

FRUITS.

Bulletin No. 80, January, 1892.

In 1889 the State Board of Agriculture authorized the establishment of a Fruit Testing Sub-station at South Haven. The work was placed in the hands of the well known horticulturist, T. T. Lyon. The enterprising fruitgrowers of Van Buren county purchased and deeded to the Board, a tract of five acres adjoining the land of President Lyon, for station purposes.

The results for 1889 and 1890 have been published in Bulletins 55 and 67. For these years we made use of the large experimental plantations of President Lyon, as it was too early for any results from our own.

The notes and observations for 1891 will be found in the following report.

The sub-station grounds are located on the shore of Lake Michigan, in the village of South Haven, and any one interested in fruitgrowing will be well repaid by visiting them. The latch string is always out.

L. R. TAFT,
Horticulturist.

Agricultural College, Mich.,
Jan. 15, 1892.

To Prof. L. R. Taft, Horticulturist, in charge of Experiment Station:

Sir—I herewith submit a report of operations under your direction, at the Fruit Testing Sub-station, at South Haven:

The convenient access from the village streets to the rear of the fruit plantations, during the summer and autumn of 1890, resulted in the pilfering of nearly the entire crop of grapes from plants bearing their first crop of fruit. The prospect of a larger crop the present season, a careful observation and record of which, when at full maturity, is essential to the full realization of the objects sought, with the necessity of some kind of protection for this purpose, led to directions to construct an adequate barbed wire fence, to serve as a barrier.

Aside from this the lack of a sufficient building, and the consequent absence of those in charge, except during work hours, left the grounds clear for trespassers, at all other times. Under these circumstances, and with the approval of the Board, I have, during the season, constructed a building to serve as an office, and temporarily as a residence, so located as to afford ready surveillance of the entire premises.

The care and oversight of these additional undertakings have, unavoidably, to a greater or less extent, interfered with, embarrassed or delayed my operations in connection with the appropriate work of the station.

Commencing with the earliest fruit to ripen.

STRAWBERRIES—*Fragaria.*

During the spring of 1890, one hundred and forty-nine varieties of strawberry, many of them new, or newly introduced, with a few not yet offered for sale, were planted at this sub-station, with the purpose, aside from merely testing the values of the varieties, to do something in the way of comparing the results of cultivating in matted rows, with what is known as hill culture.

With this purpose in view twenty-four plants of each variety were given a length of row of two rods, inclusive of three feet space between the first and second twelve plants, and an equal space between varieties; or, in other words, each twelve plants occupied a space of thirteen and a half feet, the space between rows being four feet.

With each variety, the first twelve plants were allowed to form and root runners freely, with care to keep them well upon the space assigned to the row and prevent intermingling with adjacent rows.

The vigor of the second dozen plants, of each variety, was reserved by the constant removal of runners as they appeared, thus strengthening the original plants, and turning their energies to the development of additional crowns.

On the approach of winter, the plat was mulched, as a safeguard against possible injury in winter. This mulch was removed in spring to admit of cultivation; and the ground was kept thoroughly free from weeds, till the fruit commenced to ripen.

The picking was done on alternate days, under careful supervision, the picker being required to pinch off the stems, leaving the calyx attached to the berry; and the product of each dozen plants was separately weighed and recorded, those from matted rows, and those from hills, separately.

The earlier part of the season having been more than usually favorable, the plants generally reached the fruiting season in vigorous condition, with promise of a bountiful crop. During the first half of the ripening season, these prospective indications were realized. About this time, however, the weather suddenly changed to hot and dry, occasioning a serious shrinkage of the remainder of the crop, by the withering or blasting of much that, under more favorable conditions, would probably have matured.

The healthy foliage grown under conditions already mentioned was apparently so far affected by the change that it failed and was replaced by the new growth, earlier than usual; in some cases with much apparent enfeeblement of the plant.

For this reason, apparently, there was little if any development of fungus upon the foliage, and no depredations of insects have been observed.

Even the leaf roller, which has for years been at least occasionally present, has not been noticeably present this season.

Since so many new varieties come to the public, not from the originator, but rather from the introducer, with its real origin suppressed, in the tables herewith, under the head of origin, only an approximation to the date of origination or introduction is attempted.

Certain varieties of strawberry have so few anthers as to be apparently nearly, but not quite, incapable of self-fertilization. In such cases "n. p." indicates that they are nearly pistillate.

The dates of first and last pickings of each variety give the length of time during which it is in fruit. An examination will betray the fact that neither the early nor the late varieties usually cover so long a period as do those of medium season; for which reason, apparently, their annual yield is usually less.

The columns headed "Matted Row" and "Hill," give the season's product of each variety, under each system respectively; and since the productiveness of each is thus clearly indicated, the column heretofore devoted to "Productiveness" is omitted.

The numerals in the columns headed "vigor," "hardiness," "size," "quality" and "firmness" are all based upon the scale of 1 to 10.

The newer varieties on trial are of course introduced into the tabulation whether giving indication of probable value or otherwise; while notice of a very considerable number of the less valuable older ones is wholly omitted.

The table, as may readily be seen, shows, in the great majority of cases, a larger—often a very much larger—yield of fruit from the same variety under the hill system, than from the matted row. This is by no means the only, if indeed it is the chief, advantage from that system; since such increase is not from a greater number of fruits, so much as from their greater size and beauty; as also from the increased market value, and more ready sale.

Notices are appended of a few of the more productive or otherwise desirable varieties appearing in the foregoing table.

Alpha still maintains its position as one of the most desirable of the very early varieties. Though not relatively productive, it possesses other valuable qualities which justify its continuation.

Beder Wood originated in Illinois with the person whose name it bears, who claims that plants entrusted to an Iowa man for trial fell into the hands of a person named Racster who propagated and disseminated it without the knowledge or consent of the originator, giving it his own name. It, so far, gives evidence of decided value as a market variety.

Belmont, although lacking productiveness, possesses desirable qualities for the home plantation, and may be expected to afford satisfaction when planted for such purpose. The plant is healthy and vigorous, and the fruit large, bright, and of good quality.

Bubach (No. 5), though deficient in quality and soft in texture, is yet so large, bright colored, and productive that it has already won a high position as a desirable market variety. It must be planted near a pollen-producing variety.

Crawford, though a comparatively new variety, and scarcely satisfactorily tested here, is very highly commended by its careful and conscientious originator, as well as by many others. It is believed to be eminently worthy of extensive trial.

STRAWBERRIES—*Fragaria.*

ABBREVIATIONS.

Sex.

b. bisexual.
n. p. nearly pistillate.
p. pistillate.

Origin.

The usual abbreviations for names of countries.

Form.

c. conical.
co. cockscombed.
d. depressed or oblate.
i. irregular.
l. long.
o. oval or ovate.
r. roundish.

Number.	Name.	Plant.									
		Sex.	Origin.	Received.	First bloom.	First picking.	Last picking.	Matted row.	Hills.	Vigor.	Hardiness.
1	Alabama	b	Ala.	1890	May 12	June 15	July 3	26	73	7	------
2	Alpha	b	Ont.	1881	" 8	" 12	" 3	70	60	8	10
3	Arnold's Pride	b	Ont.	1881	" 7	" 15	" 1	51	43	8	9
4	Atlantic	b	N. J.	1890	" 8	" 17	" 6	85	136	6	------
5	Beder Wood	b	Ill.	1890	" 7	" 12	" 3	144	261	8	9
6	Belmont	b	Mass.	1885	" 13	" 17	" 1	37	74	9	9
7	Bessie	p	Ala.	1890	" 2	" 12	" 1	71	87	8	------
8	Black Defiance	b	N. J.	1875	" 7	" 15	" 3	47	77	10	10
9	Bomba	b	N. J.	1889	" 2	" 12	" 3	49	90	9	8
10	Bubach No. 5	p	Ill.	1888	" 12	" 15	" 6	131	201	10	10
11	Bubach No. 24	b	Ill.	1890	" 7	" 12	" 1	22	21	6	------
12	Bubach No. 132	b	Ill.	1890	" 8	" 12	" 6	65	95	5	------
13	Bubach No. 137	b	Ill.	1890	" 11	" 12	" 3	103	90	6	------
14	Burt	b	N. Y.	1889	" 8	" 15	" 3	44	78	9	10
15	Bright Ida	b	Ont.	1881	" 8	" 17	" 8	102	149	9	9
16	Captain Jack	b	Mo.	1876	" 12	" 15	" 6	21	62	8	10
17	Carmichael	p	Ohio.	1890	" 17	" 20	" 1	15	12	3	------
18	Charles Downing	b	Ky.	1874	" 2	" 15	" 3	36	57	9	10
19	Charleston	b	Ohio.	1890	" 2	" 15	" 1	28	50	5	------
20	Cling To	b	Ohio.	1890	" 1	" 15	" 1	10	15	5	------
21	Cloud	p	La.	1888	" 9	" 12	" 1	57	98	9	10
22	Covell	b	N. J.	1888	" 8	" 12	" 1	72	75	7	6
23	Crawford	b	Ohio.	1889	" 6	" 12	" 3	56	19	9	10
24	Crescent	p	Conn.	1880	" 5	" 12	" 3	70	102	9	10
25	Cumberland	b	Pa.	1880	" 12	" 15	" 8	80	98	9	9
26	Daisy	p	Ohio.	1890	" 11	" 12	" 1	36	86	6	------
27	Dew	b	Mich.	1889	" 9	" 15	" 6	53	58	10	10
28	Duncan	b	--------	1876	" 7	" 12	" 6	57	110	10	10
29	Dutter	b	Ind.	1889	" 14	" 17	" 6	83	138	9	------
30	Early Canada	p	Ont.	1886	" 9	" 12	" 3	52	75	5	------
31	Engle No. 1	b	Mich.	1890	" 2	" 15	" 3	54	52	8	------
32	Enhance	b	Ohio.	1890	" 2	" 12	" 8	93	303	8	------
33	Eureka	p	Ohio.	1888	" 15	" 17	" 8	50	73	8	9
34	Felton	b	Ohio.	1890	" 2	" 15	" 3	80	45	6	------
35	Florence	b	Ohio.	1888	" 12	" 15	" 8	102	110	10	10
36	Galceron	b	Ga.	1888	" 15	" 15	" 6	48	74	6	9
37	Gandy	b	N. J.	1887	" 18	" 20	" 8	36	82	9	10
38	Garrettson	p	Ont.	1886	" 2	" 15	" 3	79	93	7	9
39	Gem	p	Ill.	1890	" 16	" 15	" 8	149	174	10	------
40	Glendale	b	Ohio.	1882	" 12	" 15	" 8	41	69	9	10
41	Great American	b	N. J.	1878	" 9	" 15	" 3	43	74	9	------
42	Great Pacific	p	Ill.	1890	" 7	" 15	" 6	139	212	10	------
43	Hampden	p	--------	1889	" 13	" 15	" 6	56	103	8	8
44	Hatfield	b	N. J.	1890	" 8	" 15	" 3	25	24	5	------
45	Haverland	p	--------	1887	" 1	" 15	" 3	106	205	8	9

STRAWBERRIES—*Fragaria.*

ABBREVIATIONS.

Color.

b. bright. l. light.
c. crimson. r. red.
d. dark. s. scarlet.

The scale, 1 to 10, applies in columns headed vigor, hardiness, size, quality and firmness.

Number.	Fruit. Size.	Quality.	Firmness.	Form.	Color.	Remarks.
1	6	8	8	r	d	Requires further trial.
2	4	8	5	d c	l r	The most satisfactory very early berry
3	8	8	7	i c	l r	Productive, but not attractive in color.
4	7	6	6	c	c	Lacks productiveness for market.
5	8	5	6	r	l c	Was fraudulently disseminated as Racster.
6	8	9	7	o	b s	Only desirable for home use.
7	5	6	5	co	c	Southern; needs further trial here.
8	9	8	9	r co	d c	Old; but still desirable.
9	9	8	5	c	c	Disseminated by the late Wm. Parry of New Jersey.
10	10	6	6	d c co	b c	Lacks firmness and quality; very large.
11	6	6	5	o	d r	New, and not promising.
12	8	5	6	c	b r	Has the same defects as the preceding.
13	8	6	5	c	b r	From the same source as the last three.
14	6	7	9	r d c	d r	Like Wilson but of milder flavor.
15	8	8	7	r b c	l r	Very productive, but lacks color.
16	5	6	9	r c	b c	Very productive, but rather small.
17	4	4	3	i c	b c	Poor bearer, but is better on moist soils.
18	6	7	5	r c	d s	Old, but yet holds its position.
19	5	6	6	r	d s	Is it identical with Neuman?
20	6	8	5	r c	d s	Is not promising so far.
21	7	9	9	r	d r	Hardy, as are all varieties from the south.
22	6	9	9	r	d c	Promises more than it performs.
23	10	9	9	r c	b r	Needs a more satisfactory trial.
24	7	6	6	r c	b c	Well known and successful everywhere.
25	10	7	6	d r c	l c	Too soft to bear lengthened transportation.
26	6	6	6	r c	b c	Requires more extended trial.
27	10	7	10	b r c	d s	Needs strong soil and good culture.
28	8	9	7	c	d r	Early and good.
29	9	5	5	c co	b r	Profitable with liberal culture.
30	5	5	6	c	b c	Nearly out of cultivation.
31	9	6	7	c co	r	Promising. From C. Engle, Paw Paw, Mich.
32	9	5	6	c co	d r	Has few equals in size and productiveness.
33	8	7	7	r c co	d c	A good market variety.
34	8	8	7	r c co	r	Farther frial is needed.
35	6	7	8	r c	b c	Valuable for market.
36	5	9	9	r c b	d r	From the south.
37	9	9	8	r c co	d c	Valued for its lateness.
38	5	5	6	r c	c	Not quite productive enough.
39	10	5	7	c	b c	For market, exceedingly promising.
40	8	7	7	l c	d c	Valued mainly for its lateness.
41	9	6	7	c	d r	Will only succeed under high culture.
42	9	5	8	c co	r	Promising for market.
43	9	9	8	o	b r	Promising.
44	6	5	6	o	r	A probable failure.
45	8	8	6	l c	s	A highly valuable market variety.

STRAWBERRIES.—CONTINUED.

Number.	Name.	Plant.									
		Sex.	Origin.	Received.	First bloom.	First picking.	Last picking.	Matted row.	Hills.	Vigor.	Hardiness.
46	Hinman	b	------	1890	May 13	June 15	July 3	56	128	5	------
47	Hoffman	b	N. J.	1889	" 12	" 12	" 3	28	63	8	2
48	Indiana	b	Ind.	1889	" 2	" 12	" 3	61	80	8	9
49	Itasca	p	Ind.	1888	" 2	" 15	" 3	95	10	8	10
50	Ivanhoe	b	Ohio.	1889	" 9	" 12	" 3	45	129	5	------
51	Jersey Queen	p	N. J.	1886	" 18	" 15	" 6	24	63	6	------
52	Jessie	b	Wis.	1889	" 1	" 15	" 3	31	35	9	9
53	Jucunda	b	Pa.	1876	" 17	" 17	" 8	29	55	2	3
54	Jucunda Improved	b	N. J.	1890	" 13	" 15	" 3	46	81	6	------
55	Kentucky	b	Ky.	1876	" 15	" 22	" 3	32	43	10	10
56	Lady Rusk	n p	Ill.	1889	" 7	" 12	" 3	56	118	9	10
57	Lida	p	N. J.	1886	" 7	" 15	" 6	26	89	4	4
58	Logan	b	Ind.	1888	" 9	" 12	" 3	60	112	9	9
59	Loudon No. 15	b	Wis.	1889	" 12	" 15	" 3	104	136	10	10
60	Longfellow	b	Ky.	1877	" 1	" 15	" 8	50	77	7	1
61	Louise	b	N. Y.	1889	" 16	" 15	" 3	67	92	9	9
62	Maggie	b	Ont.	1881	" 8	" 15	" 6	72	53	8	9
63	Manchester	p	N. J.	1880	" 16	" 15	" 8	129	140	7	9
64	Mark	b	Ohio.	1890	" 12	" 19	" 1	30	40	9	------
65	Martha	n p	Minn.	1887	" 11	" 15	" 8	85	137	9	10
66	Marvel	b	Ohio.	1890	" 1	" 12	" 3	74	82	5	------
67	May King	b	------	1887	" 7	" 12	" 3	79	115	8	9
68	Miami	n p	------	1889	" 9	" 15	" 3	77	155	9	10
69	Miller	b	N. J.	1890	" 18	" 20	" 3	45	39	8	------
70	Michel's Early	b	Ark.	1890	" 1	" 17	" 3	75	102	9	------
71	Miner	b	N. J.	1878	" 7	" 12	" 6	59	71	8	10
72	Monmouth	b	N. J.	1888	" 13	" 15	" 8	49	54	7	8
73	Moore	b	Mich.	1889	" 9	" 15	" 3	55	136	10	10
74	Mount Vernon	b	Kan.	1877	" 15	" 17	" 8	84	86	10	10
75	Mrs. Cleveland	p	Ohio	1888	" 15	" 15	" 3	119	184	10	10
76	New Dominion	b	Ont.	1878	" 13	" 15	" 3	63	111	7	10
77	Neptune	b	Ohio	1890	" 8	" 15	" 8	40	132	8	------
78	Ohio	p	Ohio	1888	" 17	" 22	" 8	39	81	9	10
79	Ohio Centennial	b	Ohio	1889	" 11	" 15	" 8	79	123	9	10
80	Oliver	b	------	1890	" 11	" 15	" 6	76	104	9	------
81	Ontario	b	N. Y.	1886	" 9	" 17	" 3	18	84	9	10
82	Osceola (Michel)	b	Mo.	1890	" 2	" 12	" 3	76	130	7	------
83	Parker Earle	b	Texas	1889	" 13	" 15	" 3	255	220	10	10
84	Parry	b	N. J.	1886	" 8	" 15	" 8	67	72	7	8
85	Pearl	b	N. J.	1888	" 7	" 15	" 3	75	164	10	10
86	Phelps (Old Ironclad)	b	------	1878	" 1	" 12	" 3	44	65	8	10
87	Porter	b	N. J.	1890	" 1	" 12	" 3	67	76	6	------
88	Pineapple	b	------	1889	" 12	" 17	" 8	50	57	10	10
89	Puritan	b	------	1887	" 2	" 15	" 3	16	24	4	------
90	Regina	p	Ala.	1890	" 19	" 20	" 3	11	20	8	------
91	Sadie	p	Ohio	1890	" 12	" 12	" 3	98	132	9	------
92	Saunders	b	Ont.	1889	" 15	" 15	" 6	68	186	9	10
93	Seneca Queen	b	N. Y.	1878	" 7	" 19	" 1	83	55	5	7
94	Sharpless	b	Pa.	1878	" 9	" 17	" 6	45	86	10	10
95	Shaw	b	------	1890	" 19	" 20	" 3	17	15	8	------
96	Shuster Gem	n p	N. J.	1890	" 1	" 15	" 6	79	102	8	------
97	Speece's Perfection	b	Mo.	1890	" 7	" 15	" 6	63	73	7	------
98	Stayman No. 1	n p	Kan.	1890	" 9	" 15	" 6	77	155	8	------
99	Stayman No. 2	n p	Kan.	1890	" 13	" 15	" 3	64	129	9	------
100	Stevens	b	Ala.	1890	" 1	" 12	" 1	29	49	6	------
101	Sucker State	b	Ill.	1890	" 16	" 15	" 3	69	74	8	6
102	Tippecanoe	b	Ind.	1880	" 3	" 15	" 3	55	89	9	------
103	Townsend No. 2	b	Ohio	1888	" 8	" 19	" 3	46	50	9	------
104	Townsend No. 3	p	Ohio	1888	" 12	" 15	" 3	113	111	------	10
105	Townsend No. 19	p	Ohio	1888	" 8	" 12	" 3	123	149	------	10

STRAWBERRIES.—CONTINUED.

Number.	Fruit. Size.	Quality.	Firmness.	Form.	Color.	Remarks.
46	6	7	7	r c	r	Not promising so far.
47	4	8	8	r	d r	Valued farther south.
48	5	6	6	c	l c	Of very doubtful value.
49	7	7	6	r	c	Will probably be superseded.
50	8	7	6	c co	c	Needs farther trial.
51	7	6	6	c co	c	Fails to fill the requirements for market culture.
52	10	6	7	r c co	d c	Must do better or go to the wall.
53	8	5	9	r c	b s	Has probably outlived its usefulness.
54	6	6	6	r c	d c	The improvement is scarcely noticeable.
55	7	6	7	l c	b s	Only holds its own as a late berry.
56	8	7	7	r c	b c	Others surpass it here.
57	7	7	4	r c	b c	Sets more fruit than it can mature.
58	7	7	5	r d c	b c	Of questionable value. Has too many rivals.
59	10	8	7	r c co	c	This is worthy of a name.
60	9	6	6	l c	c	A few large berries, but they soon run small.
61	9	8	6	l o c	l c	May prove a desirable market variety.
62	7	8	6	r c i	l r	Of Canadian origin; too dull in color.
63	8	8	9	r d c	c	Valuable. Plant overbears.
64	6	5	7	c	d r	Not promising so far.
65	6	7	7	r d c	d r	A hardy market variety from Minnesota.
66	9	6	5	r c	d r	Needs a longer trial.
67	4	7	5	r co c	l c	Valued as a fertilizer for pistillates.
68	8	8	8	r co	b c	May prove desirable for market.
69	6	5	4	r c	b c	Shows little indication of value.
70	6	9	7	r	c	Does not fulfill the promises made for it.
71	7	6	5	c	d s	One of the old favorites.
72	8	7	7	c	d r	Not productive enough.
73	10	6	7	d c	l r	Like Jessie, but superior to it.
74	7	8	7	r c	b s	One of the best rather late varieties.
75	8	7	8	r c	l c	Promising for the market.
76	5	6	7	d c	b c	A bright, beautiful berry; not much grown.
77	8	7	7	c co	c	Needs a more satisfactory trial.
78	8	4	5	r c	b c	Only desirable for its lateness.
79	------	------	------	--------	--------	Named for the date of its origin.
80	9	5	8	c d	c	Must have a longer trial.
81	9	8	6	b c	d s	In plant and fruit, much like Sharpless.
82	8	7	7	o	c	Needs farther trial.
83	8	9	9	l c	b c	Hardy and very productive. From Texas.
84	9	9	8	r c	l c	Large and excellent. Lacks vigor.
85	8	8	10	l c	c	A hardy variety, of southern origin.
86	5	7	6	r c	s	Valuable, mainly, as a good pollenizer.
87	6	6	6	r c co	d c	Scarcely promising.
88	8	8	------	r c	r	A fine family berry.
89	8	6	6	c co	d c	Worthless unless it shall improve.
90	8	6	7	r c	c	Apparently valueless here.
91	7	5	6	r c	d c	Try farther.
92	9	8	8	r d c	b c	A promising berry for market.
93	7	8	6	r d	b r	Old, and going out of cultivation.
94	9	8	6	b c	b c	Slightly deficient in productiveness.
95	9	6	7	r o	l c	Apparently of little value.
96	8	5	4	r c co	c	Highly praised in New Jersey.
97	8	8	7	r c	c	Scarcely productive enough.
98	7	6	6	r c	c	Promising.
99	7	6	7	r c	c	Promising.
100	6	8	7	r c	c	Of slight promise.
101	6	6	6	r c	s	Popular in its native State.
102	8	5	6	r c	c	Of foreign parentage.
103	8	9	8	r	l c	Needs a longer trial.
104	------	------	------	--------	--------	Promises value for market.
105	------	------	------	--------	--------	Very promising.

STRAWBERRIES.—CONTINUED.

Number.	Name.	Plant.									
		Sex.	Origin.	Received.	1st Bloom.	1st Picking.	Last Picking.	Matted Row.	Hills.	Vigor.	Hardiness.
106	Townsend No. 20	p	Ohio	1888	May 17	June 15	July 3	94	115	9	------
107	Triomphe de Gand	b	Belg.	1876	" 15	" 17	" 3	26	51	8	9
108	Unnamed (Nehring)	b	Ill.	1890	" 7	" 15	June 29	34	44	8	------
109	Vick	b	Mo.	1878	" 12	" 15	July 3	100	137	7	10
110	Viola	b	Ohio	1890	" 12	" 17	" 1	65	49	7	------
111	Walton	p	N. J.	1890	" 9	" 15	" 1	42	87	4	------
112	Warfield No. 1	b	Ill.	1890	" 7	" 15	" 6	64	83	8	------
113	Warfield No. 2	p	Ill.	1888	" 12	" 15	" 6	105	93	8	10
114	Wilson	b	N. Y.	1876	" 2	" 12	" 6	78	88	7	10
115	Windsor	p	Mich.	1880	" 8	" 15	" 6	71	86	6	7
116	Wonderful	b	--------	1888	" 12	" 17	" 8	82	112	10	10
117	Woodruff No. 1	b	Mich.	1878	" 9	" 15	" 6	49	78	5	8
118	Yale	b	Ct.	1890	" 18	" 19	" 8	49	37	8	------
119	Thompson No. 1	------	Ohio	1890	----------	" 19	June 29	23	34	3	------
120	Thompson No. 4	b	Ohio	1890	" 1	" 15	July 3	14	15	3	------
121	Thompson No. 5	b	Ohio	1890	" 7	" 12	June 29	23	57	5	------
122	Thompson No. 7	p	Ohio	1890	" 9	" 12	July 1	92	117	8	------
123	Thompson No. 8	p	Ohio	1890	" 1	" 12	June 29	23	112	6	------
124	Thompson No. 9	b	Ohio	1890	" 1	" 12	" 29	79	52	7	------
125	Thompson No. 17	p	Ohio	1890	" 8	" 12	July 3	22	46	5	------
126	Thompson No. 25	b	Ohio	1890	" 8	" 12	" 3	50	54	6	------
127	Thompson No. 26	p	Ohio	1890	" 9	" 12	" 1	61	52	9	------
128	Thompson No. 31	p	Ohio	1890	" 15	" 15	" 3	97	69	9	------

Cumberland, though lacking firmness of texture, and scarcely productive enough for the market, is yet of such fine size, and so perfect in form, as to render it popular even for this purpose.

Enhance is a new variety from an Ohio originator. Though but recently disseminated, our record shows that, under hill culture, it has this season produced over three hundred ounces of fruit from a dozen plants. Though of only medium quality, its size, beauty, and productiveness, as well as vigor and healthiness, render it one of the most promising market varieties.

Florence (formerly Clara) is another Ohio introduction, which to health and vigor of plant, with fair productiveness, adds fair size, good flavor, and firm texture. It may safely be planted for either home use or market.

Gandy blooms unusually late, with a consequently increased probability of escaping injury from late spring frosts. It also ripens quite late, and possesses other desirable qualities of both plant and fruit which render it highly desirable for the home plat.

Gem is a very recent introduction by Wm. F. Nehring of Strasburg, Illinois, which proves to be one of the most vigorous and productive varieties in the list. The fruit is of very large size, seldom distorted, and of medium quality and firmness. If as successful elsewhere as here, it may be expected to assume a position very near the head of the list of market varieties.

Great Pacific (a too pretentious name) is another Illinois variety of recent introduction. Although not universally successful, it has here shown itself very productive, and seems, so far, to possess valuable qualifications as a market variety.

STRAWBERRIES.—CONTINUED.

Number.	Fruit. Size.	Quality.	Firmness.	Form.	Color.	Remarks.
106	9	7	9	r c	d c	May prove valuable.
107	7	9	9	r c	b r	One of the oldest varieties; nearly superseded.
108	8	5	6	r c	d c	Not disseminated. Of doubtful value.
109	5	9	10	r	d c	Very hardy and productive, but small.
110	9	4	8	c co	l c	New; not yet well tested.
111	7	5	7	c co	d c	New; not promising, so far.
112	6	5	6	c co	d c	New; and not promising.
113	6	7	5	r c	b c	Well known and popular with planters.
114	6	8	10	c	d s	Old; less planted than formerly.
115	6	6	8	r c	d s	This and Champion prove identical.
116	6	6	8	r c	d c	So far, has not justified its name.
117	8	6	8	r d c	d c	Has not won a prominent position.
118	7	7	8	r c	d c	Must improve greatly, to win popularity.
119	5	7	7	r co	c	Needs a fuller trial.
120	6	4	5	c	c	So far, apparently valueless.
121	4	5	7	c	b c	Not promising.
122	4	5	7	r	d c	May improve upon further trial.
123	5	6	4	r c	b c	Try it farther.
124	7	8	6	r c co	r	Must improve to be desirable.
125	8	5	9	r c co	l c	Scarcely worth a farther trial.
126	5	6	5	r co	r	Try it another year.
127	7	4	6	r i	c	Try it farther.
128	5	4	6	r co	d c	Give it another chance.

Haverland still sustains its previous standing as one of the most desirable varieties for the market plantation. It must, however, be cross-fertilized.

Henderson, although lacking hardiness and productiveness, is so superior in quality that it commends itself to the home planter, who aims to secure flavor rather than mere quantity.

Manchester is large, productive, and beautiful, but it generally so exhausts itself in producing its first crop, that it is found more profitable to plow under the plants after taking off one crop.

Moore is a comparatively recent variety, originating in Michigan. It is much like Jessie in both plant and fruit, and has this year quite exceeded it in productiveness. It is a good fertilizer for such pistillates as bloom in season with it.

Mrs. Cleveland is one of Geo. W. Townsend's numerous seedlings, of Ohio. Its vigor, productiveness and bright color render it attractive. It promises well as a market variety.

Mount Vernon is an old and reliable variety. It is one of the most productive and desirable of the late varieties, and supplies an abundance of pollen, which renders it a good fertilizer for late blooming pistillates.

Parker Earle. This season, as was true of the previous one, this has yielded a greater weight of fruit than any other variety in the collection; although two or three others have approached it quite nearly. It may well stand at the head of the list, whether planted for home use, or for the market.

Parry is among the best of the large berries so far as quality is concerned; though a lack of vigor and productiveness place it in the amateur instead of the market list.

Vick, another southern seedling is abundantly vigorous and productive. Its clear, bright color would, no doubt, render it popular as a market berry, but for a lack of size. It is an abundant producer of pollen.

Warfield (No. 2) is highly praised almost everywhere for its great productiveness, fair size, firm texture, and for the hardiness and vigor of the plant. During a three years' trial here, however, it has failed to reach as high a ratio of productiveness as any one out of more than twenty others in the collection.

The following varieties, named nearly in the order of maturing, will afford a succession for a family plantation throughout the ordinary season of this fruit:

Alpha (*b*), Haverland (*p*), Parker Earle (*b*), Belmont (*b*), Parry (*b*), Mount Vernon (*b*), Gandy (*b*).

For market planting, the experience of this season indicates the following, which are named in the order of their productiveness, with no regard for sexuality or season of ripening:

Parker Earle (*b*), Beder Wood (*b*), Haverland (*p*), Enhance (*b*), Great Pacific (*p*), Bubach No. 5 (*p*), Mrs. Cleveland (*p*). The last and lowest of these yielded 303 ounces of fruit from twenty-four plants; while Crescent, under the same conditions, yielded but 172 ounces.

RASPBERRIES—*Rubus.*

Raspberry plants escaped apparent injury from the past winter.

The plants upon which this season's observations have been made had been so far affected by the growth and shade of fruit trees, among which they had been planted, that only general observations respecting vigor and productiveness were attempted.

During the past season a new plantation of raspberries, together with the other small fruits, has been made arranged to serve as the basis of future observation and experiment.

There has been a notable absence of insect depredation upon the raspberry during the season.

Anthracnose, which, in previous seasons has been the most injurious fungous enemy of the raspberry, has been less prevalent than heretofore; and, the former plantations having now been dug out and burned, it is hoped that it may be held in subjection in the new plantations.

Assuming that the botanical classification of varieties may serve a useful purpose in the choosing of varieties for planting, such classification is followed in the subjoined tabulations. In so doing, Superb is placed in the Idaeus class, in compliance with scientific authority, although the correctness of such classification may be liable to grave doubt.

A very considerable number of additional varieties, most of them new or untested in this state, so far as known, have been added to the collection the present year, and have been given a place in the new plantation made last spring. Many of these may, during the coming year, develop particulars worthy of note, though a still longer period will probably, in most cases, prove requisite to properly determine their value.

In the following notices of varieties reported last year will be found embodied the results of the additional experience of the year now elapsed.

Thompson having been transplanted to the new plat has afforded no farther indications respecting its probable value. Its chief defect, if anything, is quite likely to be deficient productiveness.

Hansell has improved its standing, as to both vigor and productiveness. It may very probably fill the place of the Thompson, should that prove unworthy.

Brinckle is quite too tender for our climate, even when protected, and will probably disappear from the lists.

Marlboro, although of indifferent flavor, and not quite vigorous enough, yet commands attention on account of the large size and fine appearance of the fruit. Its value is for the market.

Turner will command attention, chiefly where special hardiness is required. The fruit, though of fine flavor, is of very delicate texture, and deficient in size.

Reder, which hails from Berrien county, lacks vigor, and usually produces plants but sparsely; but the fine size, bright color, and excellent quality of the fruit specially commend it to those wishing to plant for a home supply.

Superb had been supposed, on the authority of its originator, to be a seedling of the Philadelphia; although, in compliance with botanical authority, it is placed in the Idæus class. Its color, when fully ripe, is very dark, and the very large berry is difficult to pick without crumbling. The plant is somewhat deficient in vigor, and produces sets but sparingly. The fruit commences to ripen quite early and continues till rather late, which renders it desirable as a variety for the family plantation.

Golden Queen, save in color, is in both plant and fruit, very much like Cuthbert, from which it is suspected to be a sport. It is, both in color and quality, much to be preferred to any of the yellow caps.

Cuthbert is still at the head of the list of the red varieties of its class, whether for market or home use. It is too generally known to need special description.

Herstine is supposed to be of Idæus parentage, from which, apparently, it derives its bright color and superior flavor, inheriting also the lack of hardiness which seems to be implanted in the species. Quite possibly, however, hybridization may have communicated to it some of the peculiarities of *strigosus*.

Brandywine—an old variety—is still somewhat popular for market planting. From its firmness of texture, it may remain ungathered for some time without essential deterioration.

Of the foregoing, Hansell for early; either Herstine or Reder for medium; and Cuthbert and Golden Queen for late, will afford a satisfactory succession for a home plantation; with the surplus, if any, adapted for market. Herstine should be protected in winter.

Brief notices of some of the desirable *occidentalis* and *neglectus* varieties are also added, as follows:

Cromwell, Doolittle, Souhegan and Tyler (named in about the order of desirability) are desirable to open the black cap season. They differ but little in season, quality, or productiveness.

Beebe is desirable, if at all, only as a yellow variety. It must be taken before it becomes discolored, as it very soon does, from overripeness. It is very productive.

Johnston Sweet and Ohio are quite similar. Both are valued mainly for drying, since, owing to the abundance and size of their seeds, they yield a large percentage of the desiccated product.

RASPBERRIES—*Rubus.*

1. *Rubus Idœus.*

Of European origin or parentage.

Number.	Name.	Plant.							
		Planted.	Origin.	First Bloom.	First Picking.	Last Picking.	Vigor, 1 to 10.	Hardiness, 1 to 10.	Productiveness, 1 to 10.
1	Brinckle	1888	Penn.	June 8	July 5	----------	4	2	2
2	Herstine	1888	Penn.	" 11	" 9	Aug. 4	7	6	5
3	Superb	1888	N. Jersey.	" 9	" 7	" 4	4	8	6

. *Rubus Neglectus.*

Botanists include in this species a class of varieties by many persons regarded as probable hybrids.

1	Caroline	1888	N. Y.	June 6	July 9	----------	5	10	10
2	New Rochelle	1888	N. Y.	" 5	" 9	Aug. 5	5	8	8
3	Philadelphia	1888	Pa.	" 6	" 9	" 7	7	10	10
4	Reliance	1888	N. J.	" 6	" 6	" 7	6	10	10
5	Shaffer	1888	N. Y.	" 7	" 9	" 7	10	10	10

3. *Rubus Occidentalis.*

Cap or tip-rooting varieties.

1	Ada	All planted in 1888.	Ohio.	June 5	July	--------	5	10	-----
2	Beebe		N. Y.	" 2	" 11	Aug	9	10	10
3	Carman		Conn.	" 3	" 9	July 5	4	10	7
4	Centennial		----------	" 9	" 11	" 28	6	10	7
5	Cromwell		Conn.	" 6	" 5	" 28	6	10	10
6	Doolittle		N. Y.	"	" 5	Aug. 1	7	10	10
7	Doomore		Ohio.	" 6	----------	----------	9	10	-----
8	Earhart		Ill.	" 6	" 9	Nov.	8	10	10
9	Gregg		Ind.	" 12	" 11	Aug. 11	10	9	10
10	Hilborn		Ont.	" 12	" 9	" 8	6	10	9
11	Hopkins		Mo.	" 10	" 5	" 4	7	10	8
12	Indiana		Ind.	" 8	" 11	" 1	5	10	10
13	Johnston Sweet		N. Y.	" 10	" 11	" 6	6	10	10
14	Mammoth Cluster		N. Y.	" 11	" 14	" 4	7	10	8
15	Nemaha		Neb.	" 11	" 14	" 4	10	10	10
16	Ohio		N. Y.	" 10	" 11	" 4	7	10	10
17	Souhegan		N. E.	" 5	" 5	July 28	7	10	9
18	Tyler		----------	" 5	" 5	" 30	7	10	9

4. *Rubus Strigosus.*

Indigenous American varieties and seedlings of these.

1	Brandywine	1888	Penn.?	June 7	July 9	Aug. 11	6	9	6
2	Crimson Beauty	1888	Kan.	" 6	" 5	July 30	6	7	5
3	Cuthbert	1888	N. Y.	" 14	" 11	Aug. 13	10	9	10
4	Eastern King	1888	N. E.	" 10	" 9	" 1	6	6	6
5	Golden Queen	1888	N. J.	" 15	" 7	" 4	10	9	8
6	Hansell	1888	N. J.	" 4	" 7	" 11	7	8	8
7	Marlboro	1888	N. Y.	" 5	" 5	" 1	8	9	10
8	Meredith	1888	N. E.	" 15	" 11	" 1	6	7	7
9	Michigan Early	1890	Mich.?	" 12	----------	----------	7	8	7
10	Miller's Woodland	1890	----------	----------	----------	----------	7	7	6
11	Rancocas	1888	N. Y.?	" 4	" 7	July 28	5	6	6
12	Reder	1888	Mich.	" 7	" 7	Aug. 1	6	8	9
13	Scarlet Gem	1888	----------	" 5	" 7	" 1	7	6	5
14	Thompson's Early	1889	Ohio.	" 7	" 5	July 23	7	7	5
15	Turner	1888	Ill.	" 4	" 5	Aug. 6	9	10	6

RASPBERRIES—*Rubus.*

1. *Rubus Idœus.*

Of European origin or parentage.

Number.	Fruit.				Remarks.
	Size, 1 to 10.	Quality, 1 to 10.	Firmness, 1 to 10.	Form.	Color.	
1	7	10	9	conical	yellow	Is dropped, as too unprofitable. Tender.
2	8	10	10	round	red	A superior family variety. Needs protection.
3	10	7	8	round	purple	Fruit crumbles badly in picking.

2. *Rubus Neglectus.*

Botanists include in this species a class of varieties by many persons regarded as probable hybrids.

1	7	8	4	round	yellow	Increases by both suckers and tips.
2	7	7	5	r. con.	purple	Has the habit and hardiness of a black cap.
3	4	4	5	round	dark	Nearly superseded.
4	8	5	9	"	dark	Seedling of Philadelphia.
5	10	9	7	"	purple	Valuable for canning.

3. *Rubus Occidentalis.*

Cap or tip-rooting varieties.

1	5	5	8	round	black	Need yet further trial.
2	5	5	8	"	orange	Forbidding in color when overripe.
3	5	7	8	"	black	Of scarcely medium value here.
4	6	6	9	"	"	Not popular.
5	7	7	9	"	"	Compares favorably with Souhegan.
6	7	7	9	"	"	The oldest and yet one of the best early varieties.
7	------	------	------	"	"	Requires another year's trial.
8	8	7	8	"	"	Produces a second crop on young canes in fall.
9	10	5	10	"	"	Slightly lacking in quality and hardiness.
10	8	10	8	"	"	Superior in quality.
11	8	6	7	"	"	Profitable.
12	7	6	9	"	"	An Indiana seedling.
13	5	7	9	"	"	Quite seedy, and therefore loses less in drying.
14	7	8	7	"	"	Old, but still valued for market.
15	10	5	10	"	"	Similar to Gregg, but hardier.
16	6	6	8	"	"	Seedy, productive; valued for drying.
17	5	8	8	"	"	Very early; valued for this reason.
18	5	8	8	"	"	Practically identical with Souhegan.

4. *Rubus Strigosus.*

Indigenous American varieties and seedlings of these.

1	6	6	9	round	red	Valued for market.
2	9	6	6	"	"	Berries frequently imperfect.
3	10	8	10	conical	"	Most popular of its class.
4	7	4	4	round	"	Not specially valuable.
5	10	8	10	conical	yellow	A supposed sport from Cuthbert.
6	6	5	7	round	red	A valuable early variety.
7	9	6	7	"	"	Large, early; of rather low quality.
8	6	5	6	"	pale red	Beautiful; but lacks quality and productiveness.
9	6	4	7	conical	dark red	Poor in flavor. Actual origin unknown.
10	6	4	7	round	"	An old variety. Nearly superseded.
11	3	5	6	"	red	Not valuable.
12	8	9	8	"	"	A moderate grower. Quality superior.
13	6	4	5	"	"	Beautiful. Lacks productiveness.
14	6	6	4	"	"	Unproductive. Try more thoroughly.
15	6	9	4	"	"	Very early. Lacks productiveness.

Earhart is often christened *Everbearing*, for the reason that it produces a secondary crop of fruit in September and October upon the canes of the current year.

Shaffer, appearing in the *neglectus* class, is an exceedingly vigorous and productive variety, with very large, purple, pubescent fruit; which, though somewhat unattractive in appearance, proves to be one of the best for canning.

Gregg and Nemaha are almost or quite identical, so far as the general appearance of both plant and fruit are concerned; though the latter, which originated in the trying climate of Nebraska, is alleged to be the hardier of the two.

A good succession of the "cap" varieties for a family garden would be Cromwell, Doolittle, or Souhegan, for early; Hilborn, medium, and Nemaha, late.

BLACKBERRIES—*Rubus*.

As in the case of raspberries, the growth and fruiting of the blackberry plantation, which has supplied the data for this report, was so far affected by the growth and shading of the fruit trees occupying the same ground, as to render the observations unreliable or unsatisfactory.

For this reason a new plantation was made last spring, and the old plants removed at the close of the season of fruiting.

BLACKBERRY.—*1. Rubus villosus.*

ABBREVIATIONS.

Origin.	Habit.	
Usual abbreviations for names of countries.	l. low.	t. tall.
	s. spreading.	tr. trailing.

Number.	Name.	Plant.								
		Origin.	Received.	Hab .	Earliest bloom.	First picking.	Last picking.	Vigor, 1 to 10.	Hardiness, 1 to 10.	Productiveness, 1 to 10.
1	Agawam	N. E.	1874	t s	June 6	July 27	Aug. 28	7	8	10
2	Ancient Briton	Mo.	1875	t	" 6	" 27	" 28	8	9	10
3	Bonanza		1880	t s	" 6	Aug. 4	" 28	6	7	9
4	Dorchester	N. E.	old	t s	" 6	July 27	" 24	5	5	6
5	Early Cluster	N. J.	1878	s	" 6	" 27	" 28	4	6	8
6	Early Harvest	Ill.	1882	t s	" 6			5	8	8
7	Erie	Penn.	1886	s tr	" 6	" 27	" 31	10	9	10
8	Kittatinny	N. J.	1850	t	" 6	" 27	" 28	9	5	9
9	Knox		1880	t	" 6	" 27	" 26	5	6	7
10	Lawton	N. Y.	1845	s	" 6	" 27	" 28	8	6	9
11	Minnewaski	N. Y.	1886	t	" 6	" 31	" 28	8	6	8
12	Nevada		1887	s	" 6			5	5	6
13	Snyder		1876	t	" 6	" 27	" 28	9	10	10
14	Stone Hardy	Wis.	1875	s	" 6			9	10	8
15	Taylor		1876	t s	" 6	" 27	" 31	9	10	10
16	Tompson Early	Ohio.	1888	s	" 6			6		
17	Wachusett	Mass.	1880	s	" 6			4	10	
18	Wallace	Wis.	1874	t s	" 6	" 27	" 28	7	8	7
19	Western Triumph		1876	t	" 6	" 27	" 28	10	9	10
20	Wilson	N. J.	1854	s tr	" 6	" 27	" 26	8	6	10
21	Wilson, Jr.	N. J.	1878	s tr	" 6	" 27	" 28	9	6	10
	Dewberry.—*2. Rubus Canadensis.*									
1	Lucretia	Ohio.	1880	tr	" 6	" 18	" 14	8	5	8
2	Windom	Minn.	1890	tr	" 6	" 18	" 14	6		

No definite statement of the relative amounts of fruit yielded by the several varieties seemed desirable, under these circumstances, and these are therefore omitted.

The dates of the origin or introduction are often so uncertain or difficult to determine correctly, that the attempt to tabulate them has been abandoned; and, instead, merely the year during which they were first received and planted is given, as an indication of the extent of their trial here.

No indications of the attacks of fungi have been observed upon the blackberry during the season.

They have also been quite generally free from insect depredations, except that the foliage of several varieties has been attacked and considerably injured by leaf miners. Should these make their appearance again, next year, it will, very probably, become necessary to apply a remedy.

Lucretia dewberry and Early Harvest blackberry open the blackberry season, very little if at all after that of the earliest black caps. The Brunton, very early and tender variety, did duty as Early Harvest for a time, very much to the discredit of the latter, which (the genuine), though small, is very productive, hardy, and even profitable for the market on account of its earliness.

Thompson (Early) has scarcely yet been brought fairly to the fruiting test here.

BLACKBERRY.—*1. Rubus villosus.*

ABBREVIATIONS.

	Form.	Color.
i. irregular.	ov. oval or ovate.	b. black.
o. oblong.	r. roundish.	

Number.	Fruit. Size, 1 to 10.	Quality, 1 to 10.	Firmness, 1 to 10.	Form.	Color.	Remarks.
1	9	8	4	r o	b	Large; good; nearly hardy.
2	6	8	7	ov	b	Nearly hardy; lacks size.
3	8	7	7	o	b	Hardy at the lake shore.
3	4	10	10	o	b	Nearly out of cultivation.
5	6	8	5	r o	b	Not of special value.
6	4	9	10	r o	b	Brunton has been sent out for this.
7	10	10	4	r o	b	Very vigorous; hardy; valuable.
8	10	10	5	o	b	One of the oldest and best; tender.
9	7	7	6	r ov	b	Worthy of extensive trial for market.
10	9	9	5	o ov	b	Acid till fully ripe.
11	10	9	6	r ov	b	Worthy of general trial for market.
12	7	6	6	o	b	Of very doubtful value.
13	6	10	4	r o	b	Superior quality; rather small; hardy.
14	6	8	6	r o	b	Hardy; fruit deficient in size.
15	8	10	5	r o	b	Canes greenish yellow; hardy, excellent.
16	------	------	------	------	b	Said to be early.
17	------	------	------	------	b	Nearly or quite thornless.
18	9	9	4	r o	b	Large and good. Desirable for home use.
19	6	10	5	ov	b	Very hardy; overbears; size not large.
20	10	7	6	o	b	Very large; flavor poor; tender.
21	10	7	6	o	b	Nearly identical with the foregoing.
1	10	8	4	o	b	Ripens nearly with the early black caps.
2	6	------	------	o	b	A new northwestern variety; claimed to be hardy.

Early Cluster proves not to be specially early, and has not, here, shown any qualities, save possibly productiveness, such as would justify its introduction to cultivation.

Agawam, Wallace, and Knox are all large and productive, and sufficiently hardy for the lake shore region; and the same is true of the Erie, which has stout, spreading, almost trailing branches, with stouter thorns than any other variety with which we are acquainted.

Kittatinny is one of the oldest, largest, and best varieties in cultivation, although deficient in hardiness, and in some localities specially liable to be attacked by fungus.

Minnewaski is very vigorous and hardy in the lake shore region, and the fruit of fine size. It is yet rather soon to speak confidently of its productiveness.

Ancient Briton and Western Triumph are very vigorous and hardy, and so excessively productive as not unfrequently to render the fruits objectionably small.

Wilson and Wilson Jr. are very nearly identical in both plant and fruit. With winter protection they are found eminently profitable as market varieties.

Windom dewberry comes from Minnesota, with a reputation for hardiness, even in that severe climate. Here, as far as fruited, it does not promise satisfactory size or productiveness.

Lucretia dewberry and Early Harvest blackberry (which ripen very nearly together), followed by Agawam or Kittatinny and the Taylor to close the season will be found a very satisfactory succession for a family plantation of this fruit.

For market, if covered in winter, the Wilsons are found eminently profitable. If without winter protection, Snyder and Taylor will be found much surer, though less in size.

CURRANTS.—*Ribes.*

Botanically, white currants are treated as varieties of *rubrum;* and since, in each case, the color is included in the name, they are classified with the red varieties.

All the varieties of *rubrum* are subject to a premature loss of foliage, generally during June and July, due probably to the presence of fungi, though Victoria and Holland appear to be at least partially exempt. Apparently the occurrence of dry, hot weather is favorable to the development of such malady.

The currant and gooseberry appear to be specially liable to the depredations of insects.

The imported currant worm, *Nematus ventricosus*, attacked the plants this year, as usual, though less persistently than last year, but yielded to a thorough application of powdered white hellebore in water.

The twig borer (whether the native or the imported we can not be sure), is still very troublesome, especially for the reason that the only remedy at present known (cutting away and destroying the affected shoots), involves the removal of the bearing wood for the following year. The depredations of this enemy have, however, been somewhat less serious this year than last; and it is to be hoped that with the removal and destruction of the old plants, and replanting with new ones in fresh soil, the enemy, if not eradcated, may be greatly reduced in numbers.

Owing to the transplanting of a large number of varieties last spring, trustworthy dates of blooming and gathering for the current year are unattainable. For this reason the dates of the report of the previous year are reproduced.

1. *Ribes aureum*—Missouri or Yellow Flowering Currant.

Number.	Name.	Received.	First Bloom.	Crop Picked.	Vigor, 1 to 10.	Productiveness, 1 to 10.	Size, 1 to 10.	Quality, 1 to 10.	Remarks.
1	Crandall	1889		Aug. 22	10	10	10	8	An improvement upon the wild type.

2. *Ribes Nigrum*—Black or Fetid Currant.

Number.	Name.	Received.	First Bloom.	Crop Picked.	Vigor, 1 to 10.	Productiveness, 1 to 10.	Size, 1 to 10.	Quality, 1 to 10.	Remarks.
1	Black Champion	1889	May 10	July 21	10	6	10	8	Differs very slightly from other varieties
2	Black Naples	1888	" 12	" 21	10	6	10	8	Vigorous, very musky.
3	Lee	1888	" 14	" 21	9	6	10	8	Closely resembles Black Naples.
4	Saunders	1890							Origin, Ontario.
5	Wales (Prince of)	1890							Origin, Ontario.

3. *Ribes rubrum*—Red and White Currants.

Number.	Name.	Received.	First Bloom.	Crop Picked.	Vigor, 1 to 10.	Productiveness, 1 to 10.	Size, 1 to 10.	Quality, 1 to 10.	Remarks.
1	Cherry	1888	May 14	July 14	9	7	10	7	Large, productive, acid.
2	Fay	1888	" 14	" 14	9	2	10	8	Cherry, with a longer cluster.
3	Holland (Long Bunched)	1889	" 14		10	3	5	5	Vigorous, but unproductive.
4	Lakewood	1890							Yet untested.
5	London Red	1890	" 14						Not fully tested.
6	Moore's Ruby	1890	" 12						Origin, Rochester, N. Y.
7	Moore's Select	1890			5				From Massachusetts.
8	Red Dutch	1888	" 12	" 14	10	7	8	9	The oldest and still the best.
9	Versaillaise	1888	" 14	" 14	9	7	10	8	Much like Cherry and Fay.
10	Victoria	1888	" 12	" 14	10	8	7	6	Valued for market.
11	White Dutch	1888	" 12	" 14	6	6	8	10	Richest and sweetest of currants.
12	White Gondoin	1890							Not new, but untested here.
13	White Grape	1888	" 9	" 14	8	6	9	8	Best white market currant.
14	Wilder	1890	" 10						Not yet fruited here.

Crandall, *Aureum*, varies so widely in the habit of growth and the productiveness of the plants, as well as in the size of the fruit, as to warrant the suspicion that it is the product not of one, but of a batch of seedlings. The fruit can only be considered desirable when cooked. It makes a rich, sprightly sauce, although the extreme thickness and toughness of the skin, even then, is a serious if not even a fatal objection. Further, if not repeated, reproduction from seed seems requisite to educe from it anything valuable.

Of the black varieties, the Champion, Naples and Lee, while they may vary somewhat in vigor or habit of plant, show little difference in productiveness so far as tested here, nor yet in the size or quality of their fruit.

Saunders and Wales have not yet yielded characteristic results here. A year or two yet is needed to properly develop their qualities.

White Dutch, when well grown, has, so far, no equal in richness and high quality for the table and no superior in beauty among the white varieties, although White Grape may slightly exceed it in size, and possibly in productiveness.

Red Dutch is still a peer among the reds, equaling Cherry, Versaillaise, and Fay in productiveness, although these slightly exceed its size.

Holland (Long Bunched), although abundantly satisfactory, so far as the plant is concerned, in a three years' trial, has sadly failed in productiveness.

A trial of a year or two longer may develop something specially valuable among the recent candidates; but, so far, the improvements of the currant have been exceedingly slight, if, in fact, they can be properly said to be improvements.

It is even doubtful if, today, it is possible to recommend a better list, for family use, than the old White and Red Dutch.

GOOSEBERRIES—*Ribes.*

The claim has been very generally made, and as generally accepted as correct, that our native varieties of the gooseberry are mildew proof; but when applied to the plant in open culture, it must certainly be taken with grave exceptions, since even the Houghton, which most nearly approaches the native type, rarely, in open exposure, wholly escapes a partial loss of foliage from mildew; while Smith and Downing, with such exposure, very generally, in midsummer, lose all save a few of the terminal leaves of each shoot. True, these two varieties, usually called natives, may, from certain of their peculiarities, not unnaturally, be suspected to possess a strain of foreign blood. Be this as it may, they certainly are too *English* in this particular.

The currant worm, *Nematus ventricosus*, where the two are growing adjacent, usually seems rather to prefer the gooseberry. Its attacks occurred unexpectedly early this season, and their inroads, when discovered, had already become quite serious. One or two thorough applications of hellebore, however, subdued them, but not till several plants had been nearly or quite denuded of foliage.

For several years past the Houghton (and that variety only) has been attacked by a malady which crumples the young foliage at the tips of the shoots, completely stopping their growth—apparently the work of a minute aphis. Cutting away the tips so affected, usually suppresses the malady, though it reappears, either during the same or the following season.

1. *Ribes cynosbati*—Wild Gooseberry.

Number.	Name.	Planted.	First Bloom.	Gathered.	Vigor, 1 to 10.	Productiveness, 1 to 10.	Hardiness, 1 to 10.	Size, 1 to 10.	Quality, 1 to 10.	Remarks.
1	Downing	1888	May 6	July 5	10	10	10	9	8	A possible hybrid.
2	Mountain	1888	" 6	" 6	10	7	10	3-9	5	Varies greatly in size.
3	Smith	1888	" 6	" 5	8	10	10		10	Affords indications of hybridization.

2. *Ribes grossularia*—European Gooseberry.

1	Auburn	1890	May 2		3			9	10	The correct name is unknown.
2	Early Orange	1890						8	10	Mildews.
3	Golden Prolific	1890	" 2							Not fully tested.
4	Industry	1889	" 6		5			8		Has mildewed badly.
5	Pearl	1890	" 4							Needs a longer trial.

3. *Ribes hirtellum*—Smooth Gooseberry.

1	Champion	1888	May 6	July 3	10		10	3	5	Vigorous, unproductive, small.
2	Houghton	1888	" 6	" 2	9	10	10	5	10	Very hardy; productive.
3	Pale Red	1890	" 5		8			5	10	Like Houghton; but more upright.

The European varieties of this gooseberry can only be successfully and permanently grown and fruited in this country, under exceptionally favorable conditions; or with special treatment to ward off the mildew, to which they are specially liable.

Downing and Smith possess certain peculiarities of plant and fruit which, with their tendency to become mildewed, seem to warrant the suspicion of possible hybridization with some of the Europeans.

Houghton has few, if any, superiors so far as quality is concerned; and, but for its small size, it would probably deserve to be placed at the head of the list.

Red Jacket and Triumph are two new varieties planted for trial last spring, and which may be expected to more fully display their qualities next season.

CHERRIES—*Prunus.*

The cultivated or improved varieties of the cherry have come to us from Europe; the sweet or Mazzard varieties having descended from a type known to botanists as *Prunus Avium*; while the acid and semi-acid families purport to derive their origin from *P. Cerasus*; said to have been imported by the Romans from Asia.

The sweet varieties, though usually hardy in southern Michigan, nevertheless suffer occasionally, during unusually trying seasons, and for this reason, doubtless, are not extensively planted; while Duke and Morello varieties, being more hardy, constitute the bulk of the plantations.

Forty-nine varieties of cherry are now growing in the station grounds, of which eighteen varieties are sweet cherries; nineteen Dukes and Morellos; twelve are Russian varieties received from Prof. J. L. Budd of Iowa, and have not yet grown and fruited sufficiently to determine with certainty to which class they are referable.

The whole number of cherry trees planted and growing is one hundred. No appearance of fungus has so far been observed.

This year, as last, the cherry slug, *Eriocampa cerasi*, has been persistent in its attacks upon the foliage, continuing its depredations well into the autumn; the destruction of a colony by the application of poisons being, in most cases, soon followed by fresh cohorts, probably, to a large extent, from adjacent, undisturbed sources of supply.

A very considerable number of varieties have bloomed and fruited this season, but the fruits have been so few and scattered that they generally were taken by birds before their ripening season could be determined.

Since botanists do not distinguish between Heart and Bigarreau, nor yet between Dukes and Morellos, we divide into but the two classes in the following tabulation:

1. *Prunus Avium*—Mazzard, or Heart and Bigarreau Cherries.

Number.	Name.	Received.	First Bloom.	Remarks.
1	Black Eagle	1888	May 15	Excellent. Not an early bearer.
2	Black Tartarian	1888	“ 14	Very large and showy. Tree very upright.
3	California Advance	1891		Failed and rebudded.
4	Cleveland	1890		Seedling by the late Dr. Kirtland.
5	Coe Transparent	1888	May 13	Said to be the finest sweet cherry.
6	Downer Late	1888	“ 12	Very hardy for a Mazzard.
7	Early Lamaurie	1891		Received from Missouri.
8	Early Purple	1891		The earliest sweet cherry.
9	Elton	1890		An excellent old European variety.
10	Governor Wood	1890		One of Kirtland's seedlings.
11	Kirtland Mary	1890		One of Kirtland's seedlings.
12	Knight Early	1890		An English seedling.
13	Mezel	1890		Verg large—European.
14	Napoleon	1891		Very firm. Good market cherry.
15	Ohio Beauty	1890		Originated by Dr. Kirtland.
16	Purity	1891		An Ohio seedling.
17	Rockport	1890		An Ohio seedling.
18	Windsor	1890		New. An Ontario seedling. Late.
19	Yellow Spanish	1890	May 14	One of the oldest and best.

2. *Prunus cerasus*—Duke and Morello Cherries.

Number.	Name.	Received.	Class.	Date of Blooming.	Remarks.
1	Carnation	1890	Morello		An old variety. Somewhat rare.
2	Choisy	1888	Duke	May 8	One of the best; but lacks productiveness
3	Dyehouse	1890	Morello		Originated in Kentucky.
4	Early Richmond	1888	Morello	May 8	The most popular market cherry.
5	Eugenie	1888	Duke	“ 4	A recent French variety.
6	Everbearing	1891	Morello		New and untested.
7	Hortense	1888	Duke	May 7	One of the best of the Dukes.
8	Late Duke	1890	Duke		Of French origin.
9	Louis Phillippe	1888	Morello	May 4	Very late. A good culinary variety.
10	Magnifique	1888	Duke	“ 13	Desirable as a late variety.
11	May Duke	1888	Duke	“ 8	The type of its class.
12	Montmorency	1888	Morello	“ 9	Vigorous. Moderately productive.
13	Montmorency Large	1890	Morello		A larger variety of the foregoing.
14	Montmorency Ordinaire	1890	Morello		No. 12 may prove identical with this.
15	Montrueil	1890	Duke	May 9	A new and promising variety.
16	Olivet	1888	Duke	“ 8	Recent. French; highly commended.
17	Royal Duke	1890	Duke		An old, but rare variety.
18	Wragg	1891	Morello		A new, hardy Morello, from Iowa.

3. *Prunus*—Russian. Species undetermined.

1	Angouleme	1888		May 9	One of the Budd importations.
2	Bessarabian	1888		“ 7	From J. L. Budd.
3	Brusseler Braune	1888		“ 12	From J. L. Budd.
4	Frauendorfer Weichsel	1888		“ 8	The name indicates German origin.
5	George Glass	1888		“ 12	From Prof, Budd.
6	Griotte du Nord	1888		“ 11	The name suggests French origin.
7	Lutovka	1888		“ 11	From Prof. J. L. Budd.
8	Oignies	1888		“ 10	A very poor grower.
9	Ostheim	1888		“ 8	From Prof. Budd.
10	Sklanka	1888		“ 9	From Prof. Budd.
11	Spate Amarelle	1888		“ 9	From Prof. Budd.
12	Strauss Weichsel	1888		“ 11	From Prof. Budd.

Of the sweet varieties:

Early Purple is probably the most desirable of the very early ones,

usually ripening a few fruits as early as the beginning of June; size, scarcely medium; color, dark purple, almost black; quality, fair.

Coe Transparent, one of the most beautiful of the sweet cherries, follows the foregoing. The tree is vigorous and productive, ripening its fruit about with the earliest acid cherries.

Elton and Black Eagle, the former pale yellow, with a red cheek, and the latter black, will constitute a good succession with the foregoing.

Downer Late and Yellow Spanish will ripen next. The former a large, light red, very productive variety; and the latter very firm, the type of the Bigarreaus, but unfortunately liable to crack and decay if warm, moist weather occurs during its ripening season.

Windsor is a very recent accession to this class of cherries, said to ripen even later than the foregoing. If the high commendations of prominent horticulturists who have fruited it, shall be verified, it may doubtless be planted to close the season in succession with the foregoing.

Of the Dukes and Morellos:

Choisy, ripening about the middle of June, may well be assigned the first place as the finest, as well as the most beautiful of cherries, of any class, its only drawback being its somewhat deficient productiveness.

Early Richmond, ripening with the foregoing, will well serve the need of this season for culinary purposes.

May Duke, the type of the class of Dukes, comes in about this time, and with Montmorency for cooking, will extend the cherry season till the end of June.

Late Duke and Louis Phillippe will extend the season nearly or quite through July, while Magnifique may be used to continue this fruit well into August.

For a market list of sweet cherries, a good selection would be: 1st, Black Tartarian; 2d, Napoleon; 3d, Downer.

Of Dukes and Morellos:

1st, Early Richmond and May Duke; 2d, Louis Phillippe and Magnifique.

MULBERRY—*Morus.*

Although the Mulberry is occasionally found, indigenous, in Michigan forests, those introduced to cultivation are believed to be generally of foreign parentage, and can scarcely be considered hardy, even in southern Michigan, except under specially favorable conditions.

Downing, sometimes designated as Everbearing, is an American seedling of Multicaulis (*Morus alba*) ripening its fruit in succession during a considerable period. It fails to withstand even the average winters of central Michigan, and even in the milder winters of the lake shore region it is occasionally injured.

Hicks (of the real parentage of which we are not informed) is similar in habit of growth to the foregoing. It came out of the recent winter (the first since planting it here) uninjured. It is said to have originated in Kentucky.

New American has been in cultivation several years at least. It is quite distinct in habit of growth from either of the foregoing, and appears to be somewhat hardier than Downing. Quite possibly it may be a seedling of the native red mulberry (*M. rubra*).

Russian (occasionally catalogued by nurserymen as *M. Siberica*) is supposed to be a hardy form of the European or Asiatic, *M. nigra.* The

tree has a spreading, almost drooping habit, withstanding the climate here perfectly. The fruit, which is produced abundantly and in succession, varies in color from purplish black to creamy white. It is utterly worthless, although obviously relished by the birds.

Tea's Weeping, planted here in 1889, is a chance seedling, originating in Missouri. It is even more decidedly weeping than the Kilmarnock Willow, and the foliage is also more attractive. It should, of course, be grafted upon an upright stock, at standard height. It is obviously a seedling of the Russian mulberry

SERVICE BERRY—*Amelanchier.*

This is indigenous in Michigan forests, as a large shrub or small tree from ten to fifteen feet in height, under the name June Berry or Shad Bush.

The dwarf varieties only are on trial here.

The common dwarf variety, grown here since 1876, lacks productiveness, and, as compared with certain varieties of our native huckleberry, which it resembles, it is also deficient in flavor.

Success, also a dwarf variety, hailing from Pennsylvania, planted here in 1890, is said to be more productive than the foregoing. Not yet fully tested here.

Yet another dwarf variety, known as Mammoth, was received from Indiana and planted here last spring.

The last two have not yet shown fruit enough to warrant conclusions respecting their comparative merits.

PEACHES—*Prunus Persica*, *Amydalus Persica*, *and Persica Vulgaris* (of various botanists).

Of the peach, there are at present thirty varieties of the planting of 1888; five planted in 1889; sixty-four planted in 1890; and fifty planted in 1891; total, one hundred and forty-nine varieties, comprising two hundred and fifty-five trees in orchard, together with about seventy trees in nursery, intended for planting in the spring of 1892. Most of these last are gratuities, largely from the Pike County nurseries of Missouri.

Most of the trees planted in 1888 showed more or less bloom the past spring, and many of them set a little fruit, only occasionally one of which came to maturity, owing, quite probably, to the prevalence of leaf curl, *Taphrina deformans*, which checked the growth, and nearly ruined the earlier foliage.

No other fungus has been observed to affect the peach, except in the case of a serrate-leaved variety, named Champion, received from Allegan county, as originating there, which became badly affected by a species of mildew to which, in this climate, the serrate-leaved varieties seem especially subject.

Of insects, the borer (*Ægeria exitiosa*), had effected a lodgment in a few trees, standing in a light soil, which were "wormed" in September.

The only other troublesome insect, so far as the peach is concerned, was the curculio; and, owing to the sparseness of the fruits, all effort to save them from the depredations of the "Little Turk" was omitted.

The dates and character of the bloom of a considerable number of varieties, many of them of the newer varieties, were noted; together with the character of their leaf glands. These would be most effectively given in a tabulated list of varieties; but, since none of the newer varieties are yet in fruit, such tabulation, involving as it would a very considerable

amount of time and labor, is deferred till the trees shall be in condition to supply the particulars of fruitage also.

PLUMS—*Prunus.*

Of the plum, eighty-one varieties have now been planted: in 1888, fourteen varieties; 1889, four varieties; in 1890, fifty-seven varieties, and in 1891, six varieties.

In most cases two trees of each variety have been planted, except that in several cases but a single tree could be obtained. In such case a stock has been planted in the vacant place and budded or grafted with the desired variety.

Of the varieties thus planted the following are the botanical characters, so far as they can now be determined:

14 Americana.	3 Chicasa.
42 Domestica.	1 Myrabolan.
10 Orientalis.	11 Undetermined.

Several of the older trees showed more or less bloom, and a few set some fruit; but specimens were so few and scattering that it was felt to be impracticable to save them from being punctured by the curculio, *Conotrachelus nenuphar*, who accordingly appropriated the crop, besides leaving his mark upon more or less of the scattering peaches upon the adjacent trees.

The Rose Chafer (*Macrodactylus subspinosus*), which, last year, attacked the foliage of the plum to a slight extent, came this year in greatly increased numbers, riddling the foliage of a few trees. They were kept in check chiefly by hand-picking.

The slug (*Eriocampa cerasi*) has also, this season, attacked the plum foliage with great persistence, renewing the attacks with fresh forces, so soon as the remedies applied had become spent.

The *Americana*, *Chicasa*, and *Orientalis* varieties have been nearly or quite exempt from the attacks of fungi, which has been far from true of many of the varieties of *Domestica*, many of which have obviously been seriously checked in growth by the injury of their foliage.

The disease known as plum pockets which, last year, attacked a few trees of *Chicasas*, has appeared again this season in a very few cases. The cutting away and burning the diseased wood seems to be gradually subduing it.

The tabulation and classification of varieties, with dates of blooming, etc., is deferred till, from the trees in fruit, this can be done with more correctness and certainty.

In connection with this it may be remarked that several of the recently imported Oriental plums, received from P. J. Berckmans of Georgia, in the spring of 1890, came through the past winter entirely uninjured. Even the Kelsey, which has been reported tender, so far south as Ohio and Pennsylvania, although left fully exposed, came out in good condition and made satisfactory growth the present season.

GRAPES—*Vitis.*

Of the grape, forty-one varieties were planted in 1888; forty additional varieties in 1889; forty-five others in 1890, and eight varieties, additional, in 1891; making a total of one hundred and thirty-four varieties now upon the place; with the exception of a single variety—the Rockwood—which, though planted in 1890, and replanted in 1891, has failed to grow in both cases.

GRAPES.—*Vitis*.

ABBREVIATIONS.

Species.
A. Æstivalis.
H. Hybrid.
L. Labrusca.
R. Riparia.
X. Cross.

Fungi.
A. Anthranose.
B. Black rot.
D. Downy mildew.
P. Powdery mildew.

Bunch.

Size.
l. large.
m. medium.
s. small.

Form.
l. long.
m. medium.
s. short.
sh. shouldered.

Compactness.
c. compact.
l. loose.
m. medium.

Number.	Name.	Plant.							Fruit.							
									Bunch.			Berry.				
		Received.	Species.	Vigor, 1 to 10.	Hardiness, 1 to 10.	Productiveness, 1 to 10.	Date of Blooming.	Fungi.	Size.	Form.	Compactness.	Size.	Form.	Color.	Bloom.	Pulp.
1	Adirondack	1890	L	6	4	4			l	l	c	l	r o	b	b	b
2	Agawam	1888	H	10	8	9	June 24	D	m	l, sh	l	l	r	d r	g	s
3	Aminia	1888	H	8	8	9	" 23		m	sh	c	l	r	b	b	s
4	August Giant	1889	H	10	10	9	" 23		l	sh	m	l	o	b	b	s
5	Barry	1888	H	10	8	10	" 24	D	l	s sh	c	l	r	b	b	b
6	Beagle	1889														
7	Bell	1889														
8	Black Eagle	1890	H	9	9	10			m	l	c	l	o	b	b	s
9	Blanco	1889														
10	Brighton	1888	L X	10	8	10	June 25	D	l	l	c	l	r	r	l	s
11	Brilliant	1889		8	10		" 24	D	m	l	c	m	r	r		
12	Burnet	1891	H	7	10	10			s		l	s	r	w	w	s
13	Cambridge	1890	L													
14	Campbell	1889														
15	Catawba	1888	L	9	8	9			m	l	c	l	r	r	w	t
16	Cayuga	1889	L													
17	Caywood, No. 50	1888	L	8	9				m	s	c	m	r	b	b	s
18	Centennial	1890	A X	4	6	10		P	s			s	r	w	w	s
19	Challenge	1890	L X													
20	Champion	1889	L	8	10	10	June 24		l	sh	c	l	r	b	b	t
21	Chidester, No. 1	1888	L	6	10		" 24				c	m	r	r	w	s
22	Chidester, No. 2	1888	L	8	10		" 22				c	m	r	r	w	s
23	Clevener	1890														
24	Clinton	1891	R	10	10	10			s	s	c	s	r	b	b	
25	Columbia	1891	R													
26	Concord	1888	L	10	10	10	June 24		m l	l	c	m	r	b	b	t
27	Cortland	1890	L													
28	Cottage	1890	L													
29	Creveling	1890	L	8	9	7		D	l	l	m	m	r	b	b	s
30	Delaware	1888	H	6	8	10	June 24		s	sh	c	s	r	r	w	m
31	Diamond	1889	L	8	9		" 27		l	sh	c	m	r	w	w	s
32	Diana	1888	L	9	9	9	" 22		s	s	c	m	r	r	g	t
33	Downing	1889	H	5	5	10			l	sh	l	m	o	b	b	b
34	Dracut Amber	1890	L	9	10	8			l	sh	c	l	r	r		t
35	Duchess	1888	H	6	7	8		D	l	sh	c	m	r	w	w	s
36	Early Market	1889														
37	Early Victor	1888	L	6	8	9	June 22		m	sh	c	m	r	b	b	s
38	Eaton	1888	L	10	10		" 27		l	sh	c	l	r	b	b	t
39	Elaine	1889	H													
40	El Dorado	1889	H	8	7				l					y	w	s
41	Elvira	1890	R X	9	9	10			s	sh	c	m	r	g	w	s
42	Empire State	1888	L X	10	8	7	June 26	P	l	sh	c	m	r o	w	w	m
43	Essex	1889	H						m	sh	c	l	r	r b	b	s
44	Esther	1890														
45	Etta	1890	R X													

GRAPES.—*Continued.*

ABBREVIATIONS.—*Continued.*

Berry. Size.	Berry. Form.	Color.	Bloom.	Pulp.	Flavor.	Quality.
l. large.	o. oval.	b. black.	b. blue.	a. astringent.	a. acid.	b. best
m. medium.	r. round.	d. dark.	g. gray.	b. breaking.	f. foxy.	g. good.
s. small.	ob. obovate.	g. green.	l. lilac.	m. medium.	m. mild.	v. very.
		l. lilac.	p. purple.	s. soft.	s. sweet.	
		p. purple.	t. thin.	t. tough.	v. vinous.	
		r. red.	w. white.			
		w. white.				
		y. yellow.				

Number.	Fruit. Flavor.	Fruit. Quality.	Fruit. Ripe.	Remarks.
1	v	b	Sept. 15	Very unreliable. Amateur only.
2	v	v g	Oct. 1	Valued as a long keeper.
3	s v	v g	" 1	One of the best of the Rogers' hybrids.
4	s v	v g	Sept.	An enormous grower. Prolific bearer.
5	s	v g	"	A good keeper.
6				One of T. V. Munson's seedlings. Not yet fruited here.
7				" " " " " "
8	s	v g		Highly praised in Missouri.
9				Seedling by Munson, of Texas. Not yet fruited here.
10	s v	b	Sept. 20	One of the best. Not a long keeper.
11			Oct.	Fruit mildewed badly.
12	s	v g	Sept. 10	Berry small; very sweet. Seeds many; large.
13				Not yet fruited here.
14				Seedling from T. V. Munson, of Texas.
15	v	v g	Oct.	Needs a long season to fully mature.
16				From central New York. Not yet fruited here.
17	s v	v g	Sept.	A seedling by the late A. J. Caywood, of Marlboro, N. Y.
18	s	b	"	Vine a feeble grower so far. Productive.
19				Said to be very early and prolific. Not yet fruited here.
20	f	g	Sept.	Too poor in quality. Early.
21	s v	b	"	A seedling by C. P. Chidester, Battle Creek, Mich.
22	s v	v g	"	" " " " "
23				Not yet in fruit here.
24	a	g	Oct.	Needs to be ameliorated by frost.
25				Not yet in fruit here.
26	f	g	Oct.	The leading market variety.
27				Introduced from Ontario. Not yet fruited.
28				Said to resemble Concord, but earlier.
29	s v	v g	Oct.	Sometimes sets its fruit sparsely.
30	s v	b	Sept.	Very productive. Valuable.
31	s v	v g	Oct.	New, promising.
32	s	v g	"	An excellent keeper.
33	s v	g	"	In fruit and plant resembles vinifera.
34	f	g	Sept.	A slight improvement upon the wild type.
35	s	b	"	Requires special care to escape mildew.
36				Seedling by T. V. Munson. Not yet fruited here.
37	s	v g	Sept.	Said to be earlier than Hartford.
38	v	g	Oct.	Much like Concord, but larger in bunch and berry.
39				Seedling by C. Engle, of Paw Paw, Michigan.
40	s v	b		Parentage partially vinifera.
41	s	g	Oct.	Not satisfactory so far north.
42	m	v g	"	Scarcely sustains its early reputation.
43	s	v g	Sept.	One of the Rogers' hybrids.
44				New. Disseminated by Josselyn, of Fredoria, N. Y.
45				Not yet fruited here. Origin, Missouri.

GRAPES.—Continued.

Number.	Name.	Plant.						Fruit.							
		Received.	Species.	Vigor, 1 to 10.	Hardiness, 1 to 10.	Productiveness, 1 to 10.	Date of Blooming.	Fungi.	Bunch. Size.	Bunch. Form.	Bunch. Compactness.	Berry. Size.	Berry. Form.	Color.	Bloom.	Pulp.
46	Eugenie	1891														
47	Eumelan	1888	A	7	10	5	June 27		l	sh	c	m	r	b	b	s
48	Eva	1889	L													
49	Excelsior	1889	H	5	8		June 24		l	sh	c	m l	r o	r		s
50	Gaertner	1889	H	6	8	5			m	s	c	m	r	r		s
51	Goethe	1889	H	7					m	sh	m	l	o	g		s
52	Golden Drop	1889	L X	5	7	8			s	s	m	s	r	w		s
53	Golden Gem	1890	H	4												
54	Green Mountain	1889		6												
55	Guinevra	1891	H													
56	Hartford	1889	L	8	10	10			l	sh	c	m	r	b	b	t
57	Hayes	1888	L	6	10	6	June 27		m	sh	c	m	r	w	w	s
58	Herbert	1889	H	8	8	7	" 24		l	sh	c	l	r	b	b	s
59	Highland	1889	H	8	9	9			l	sh	c	l	r	b	b	s
60	Honey	1891	H													
61	Iona	1888	L	8	7	10	June 26		l	sh	l	m	o	r	w	s
62	Isabella	1888	L	9	6	8	" 24		l	sh	l	l	o	r	b	t
63	Israella	1888	L													
64	Ives	1890	L	9	9	10			m	sh	c	m	o	b	b	t
65	Janesville	1889	L R	10	10	7	June 21		s	s	c	m	r	b	b	t
66	Jefferson	1888	L X	8	10	6		D	l	sh	c	m	r o	r	l	s
67	Jessica	1888		5	10	10	June 24		s	s	m	s	r	w	w	s
68	Jewell	1889	L	5	8	6			s	s	m	s	r	b	b	s
69	Lady	1888	L	4	8	5			s	s	m	m	r	w	w	s
70	Lady Washington	1888	H	8	6	6		D	l	sh	l	m	r	w	w	s
71	Leader	1890														
72	Leavenworth	1890														
73	Lindley	1889	H	8	5				m	sh	c	m	r	r		s
74	Lutie	1890	L													
75	Martha	1889	L	7	10	7			m	sh	c	m	r	w	w	t
76	Massasoit	1888	H	9	9	8	June 23	D	s	sh	l	l	r o	r	g	s
77	Merrimac	1888	H	9	9	8	" 24	D	m	s	c	l	r	b	b	s
78	Michigan	1889	H													
79	Mills	1888														
80	Minnesota, Beauty of	1890	L X	6	10				m							
81	Monroe	1889	L	7	10	7	June 26		m	sh	c	l	r	b	w	s
82	Moore Early	1888	L	6	10	7	" 24		m	s	c	l	r	b	b	m
83	Moyer	1888		7	8	8	" 23		s	s	c	s	r	r	w	[illegible]
84	Naomi	1889	H	8	6	7			l	sh	c	m	r o	w	w	[illegible]
85	Nectar	1888	H	7	4	3	June 27	D	l	sh	c	m	r	b	b	s
86	Niagara	1888	L X	10	9	10	" 24		l	sh	c	m	r	w	w	m
87	Northern Light	1890	L ?	6	10											
88	Olita	1889	H													
89	Oneida	1890	H													
90	Osage	1890														
91	Owosso	1890	L													
92	Ozark	1890														
93	Palmer	1890	L	8	10				l		r	l	r	b	b	s
94	Peabody	1889	R X	5					m		c	m	o	b	b	s
95	Perkins	1889	L	7	10	10	June 23		m	sh	c	l	o	w	w	t
96	Pocklington	1888	L	8	10	10	" 26		l	sh	c	l	r	w	w	s
97	Prentiss	1888	L	6	5			D	m	s	c	m	r	w	w	s
98	Progress	1890														
99	Purity	1889	H X													
100	Rentz	1889	L		10							l	r	b	b	
101	Requa	1890	H	6		8			l	sh	c	m	r	g r		
102	Rochester	1890		10	10				l	sh	c	m	r	p	w	s
103	Rockwood	1890	L													
104	Rogers, No. 5	1889	H	7	10				m		c	l	r	r	w	
105	Rogers, No. 8	1889	H	9	9		June 24		l	s	c	l	r	r	g	

GRAPES.—CONTINUED.

Number.	Fruit.			Remarks.
	Flavor.	Quality.	Ripe.	
46				But recently planted here. Not yet fruited.
47	s	v g	Sept.	More productive than generally reported.
48				From Penn. Said to be much like Martha.
49	s	v g	Oct.	Too late for this latitude, with open exposure.
50	s	v g	Sept.	Not yet fully tested here.
51	v	v g	Oct.	Needs a warm exposure in this latitude.
52		v g	Sept.	Not yet fully tested.
53				Not yet fruited here.
54				Not yet fruited here, under this name.
55				Not fully tested. A seedling by C. Engle, Paw Paw, Mich.
56	s v	g	Sept.	Poor quality. Berries drop as soon as ripe.
57	s	v g	"	A pure native. Quality excellent.
58	s	v g	"	Considered one of the best of the Rogers hybrids.
59	s v	v g	Oct.	Rather late for this latitude.
60				A recent seedling by Engle, of Paw Paw, Mich.
61	s v	b	Oct.	One of the best, where it succeeds.
62	s a	v g	"	One of the oldest varieties.
63				Plants prove spurious.
64	s	g	Oct.	Farther south, prized as a wine grape.
65	v	g	Sept.	Desirable where great hardiness is required.
66	s v	v g	Oct.	Similar to Iona.
67	s	b	Sept.	Very sweet. Seeds many; large for size of berry.
68	s	g	"	But partially tested.
69	s	v g	"	Best amateur white grape.
70	s	v g	Oct.	Of partial Vinifera parentage. Liable to mildew.
71				Needs farther trial. Promising.
72				Received from Dr. Stayman of Kansas.
73	s	v g	Sept.	Early and a good amateur variety.
74				Not yet fruited here.
75	s f	g	Sept.	Very hardy. Very foxy.
76	s	v g	"	Early. Valuable.
77	s	v g	"	A good market grape.
78			"	One of C. Engle's seedlings. Needs farther trial.
79			"	Not yet sufficiently tested.
80				Not yet in fruit here.
81	s v	v g	Sept.	An excellent amateur variety.
82	v	g	"	Early. Only medium in productiveness and quality.
83	s	v g	"	Quite early. Bunches often small and imperfect.
84	s	v g	Oct.	One of the Ricketts seedlings.
85	s	v g	Sept.	Formerly Black Delaware. Foliage not healthy.
86	s v	g	"	Valuable white. Market variety.
87				From Ontario. Not yet in fruit here.
88				One of C. Engle's seedlings; not yet fruited here.
89				From N. Y. Said to be a long keeper.
90				From Dr. J. Stayman, Kan. Not in fruit here.
91				Originated at Owosso, Mich. Not yet in fruit here.
92				From Dr. J. Stayman, Kan. Not yet fruited here.
93			Sept.	An unrecognized (probably old) variety. Not yet fruited here.
94	s	v g	"	Needs farther trial.
95	s	g	"	Foxy. Very low in quality. Early.
96	s	v g	Oct.	Excellent when fully ripe. Needs the entire season.
97	s	v g		So far, proves tender, and unproductive here.
98				From Dr. Stayman, Kan. Not yet fruited here.
99				From G. W. Campbell, Ohio. Needs farther trial here.
100				Needs a farther trial here.
101			Sept.	But partially tested here.
102	s v	v g	"	Not yet fully tested here.
103				A recent introduction by Josselyn of N. Y.
104	s	v g	Sept.	Requires farther trial here.
105	s	v g	Oct.	But partially tested here.

GRAPES.—Continued.

Number.	Name.	Plants.							Fruit.							
									Bunch.			Berry.				
		Received.	Species.	Vigor, 1 to 10.	Hardiness, 1 to 10.	Productiveness, 1 to 10.	Date of Blooming.	Fungi.	Size.	Form.	Compactness	Size.	Form.	Color.	Bloom.	Pulp.
106	Rogers No. 24	1889	H													
107	Rogers No. 30	1889	H						l			l		r		s
108	Rommel	1889														
109	Salem	1888	H	10	8	7	June 24	D	m	sh	c	l	r	d p	g	s
110	Secretary	1890	H	6	8			D	l	sh	c	l	r o	p	g	s
111	Telegraph	1890	L	8	10				m	sh	c	m	r o	b	b	s
112	Themis	1891	H													
113	Triumph	1890	H	10					l	sh	c	l	r	w	w	s
114	Ulster	1888	L X	6	9	6	June 22		l	sh	c	m	r	r		s
115	Vergennes	1890	L						l	sh	c	m	r	r	p	s
116	Victoria	1890	L													
117	Wells	1890														
118	White Ann Arbor	1888	L	5	10									w	w	t
119	White Beauty	1890														
120	White Imperial	1890														
121	Wilder	1888	H	7	9	8	June 25	D	l	sh	c	l	r	p b	b	s
122	Willis	1890	HX	7	9				m	sh	c	m	r	g y		s
123	Winchell	1889		7	9	9			m	sh	c	m	r	g y	w	s
124	Witt	1889														
125	Woodruff	1888	L	10	10	8	June 24		l	sh	c	l	r	r	g	m
126	Worden	1888	L	9	10	9	" 24		l	sh	c	l	r	b	b	s
127	Wyoming	1888	L						s		c	m	r	r	g	m

The past season has, mainly, been a favorable one for the grape; and nearly all the varieties planted in 1888, and a very considerable number of those planted in 1889, have fruited the present season. The cool weather of August and early September had the effect to retard the process of ripening, so that only a very few of the earliest varieties could be said to be fully mature, even as late as September 15, soon after which date a heated term occurred, quite unusual, so late in the season, hastening the process of ripening, and bringing the mass of varieties, excepting only a few of the latest, to maturity nearly together. This circumstance, together with my unavoidable absence of a few days during this period, has rendered an accurate record of the ripening period of the varieties impracticable for the present year.

Insect depredations have been but slightly troublesome during the season, although an occasional rose chafer was detected attacking the clusters when in bloom. When discovered these were, of course, destroyed at once.

During the early part of the season the weather was favorable to growth and the plants appeared in perfect health and vigor, begetting the hope that they would escape the attacks of mildew and rot. This hope, however, proved fallacious.

On or about August 1, Empire State, Brighton, Salem, and one or two others of the Rogers hybrids, betrayed occasional appearances of mildew, mainly upon the stems or foliage; and, in a few cases, extending to the berries. Application to the druggists failing to secure copper carbonate, it was ordered from Chicago, which delayed its application till August 7, when a thorough spraying was given wherever mildew was apparent. Either this or unfavorable atmospheric conditions, arrested further devel-

GRAPES.—Continued.

Number.	Flavor.	Quality.	Ripe.	Remarks.
106	------	------	----------	Not yet fruited here.
107	------	------	----------	Must await more satisfactory trial.
108	------	------	----------	Seedling from T. V. Munson, Texas. Not yet fruited here.
109	s	v g	Oct. ----	Popular as a market grape.
110	s	b	----------	Not yet fruited here.
111	s	g	Sept. ---	Origin, N. Y. Rarely planted.
112	------	------	----------	Seedling by C. Engle, Paw Paw, Mich.
113	s	v g	Oct. ----	Too late for Michigan, save in favorable locations.
114	s v	b	Sept. ---	Excellent for the table Promising for market.
115	s v	v g	" ----	Requires further trial.
116	------	------	----------	Not yet fruited here.
117	------	------	----------	Planted 1890. Not yet in fruit.
118	s	g	Sept. ---	Not yet in fruit. Not esteemed valuable.
119	------	------	----------	Not yet in fruit here. Stayman.
120	------	------	----------	From Dr. Stayman, Kansas. Not yet fruited here.
121	s v	v g	Sept. ---	Nearly as large as Salem, and quite as desirable
122	s	g	----------	Has not shown fruit here.
123	s v	b	Sept. ---	Now shown to be identical with Green Mountain.
124	------	------	----------	Has not yet fruited here.
125	s	g	Sept. ---	A showy market grape of fair quality.
126	s	v g	" ---	Resembles Concord, but larger, earlier, and better.
127	s	g	" ---	Requires further trial.

opment of the disease, so that the yet unaffected portions of the crop continued healthy.

Having been notified that a committee of the State Board of Agriculture might soon be expected to examine the work of the Station, the gathering of the crop of grapes was deferred till October 7, when the visit occurred. At this date several of the earliest varieties, such as Moyer, Jessica, Early Victor, and others, although otherwise still in good condition, had become so far desiccated as to be almost in the condition of raisins; while Catawba, Isabella, Diana, and one or two of the Ricketts seedlings, were still partially unripe.

For reasons stated, certain particulars introduced into the following tabulation, are unavoidably more or less imperfect.

It is also the case that the line of demarcation between the different species of the genus *Vitis* is either not very accurately defined, or generally understood; while hybridizations, either known or merely suspected, and in many cases not even *stated*, have so blended specific characteristics that it seems inexpedient if not impracticable to attempt a botanical classification of varieties.

Persons who prize quality, and desire to secure this, even with slightly diminished productiveness, and some additional care and labor, will find abundant satisfaction, for dessert purposes, from a plantation of the following, named, as nearly as practicable, in their order of ripening:

Green Mountain or Winchell (now shown conclusively to be identical) which it is now proposed to re-christen *Clough*, in honor of the actual originator—the late James Milton Clough, of Stamford, Vermont; has, under the name Winchell (bestowed by Ellwanger and Barry, who were its earliest propagators) produced a fine crop of fruit here the past season,

proving it to be one of the finest, if not in fact the finest, of the very early grapes.

Delaware will closely follow this, and is too well and favorably known to need description or characterization.

Lady has now won an assured position, as one of the finest of the earlier, hardy, white grapes.

Brighton stands at the head of the list, so far as beauty and superior quality are concerned. It is a heavy bearer, when grown adjacent to a good pollinating variety. Spraying with copper carbonate will readily overcome its slight liability to injury from mildew.

Ulster has, so far, proved somewhat deficient in vigor, though not objectionably so. Its good size, apparent hardiness, productiveness, and fine quality, are abundant recompense for such deficiency.

Iona, or, where this fails, Jefferson, will suffice for the latest variety. Both are of superior quality and similar in several respects.

As a long keeper either Agawam or Diana will be found satisfactory.

The following will afford a good succession for market purposes:

A few plants of Moore's Early, to open the market.

Worden is much like Concord, but larger, earlier, and better.

Niagara may now be said to have taken an assured position, as following the Worden, and as the rival of the Concord, which it fully equals, possibly even exceeds, in productiveness and quality.

Pocklington, as a late variety, has very large and showy bunches, of good quality, though with too much "native aroma" to suit fastidious tastes. The plant is hardy but will hardly equal certain others in vigor.

Woodruff (a native of Michigan) can very well take the place of the foregoing, if its color (red) is considered preferable.

Eaton is quite new, and as yet not fully tested. It is, apparently, merely an *exaggerated* Concord. A few trial plants may, very properly, go into the commercial vineyard, since the very large size of both bunch and berry will be quite likely to "fill the eye" of the average buyer.

PEARS—*Pyrus communis.*

Of pears, varieties have been planted as follows:

	No. of varieties.
In the year 1888	23
In the year 1889	12
In the year 1890	14
In the year 1891	18
Total	67

Of those planted in 1891, the larger part had been procured in the spring of 1890, and temporarily planted in nursery, for the reason that the ground intended for them was preoccupied by other crops.

Of insects, the only one especially troublesome to the pear this season, was the slug, *Eriocampa cerasi* which, this season, has been even more persistent in its attacks than heretofore; fresh irruptions appearing to take the places of those destroyed.

The fungus (supposed to be *Morthiera mespili*) which so seriously affected the foliage of several varieties last year, has appeared again the present season, seriously checking their growth, though not apparently extending its attacks to other trees.

Late in the season two trees received from Prof. J. L. Budd of Ames, Iowa, as Chinese pear, which had made a vigorous growth during the season, were attacked by blight, which rapidly extended to the entire trees, so that it became necessary to cut both wholly away, leaving only a small shoot from the stocks upon which they had been worked, well beneath the surface.

The contagion also manifested itself upon an adjacent tree of Emile d'Heyst, though much less severely; and also upon a large tree, top-grafted with Idaho pear, which is so seriously affected that it may, very possibly, require to be wholly cut away.

None of the pears have yet shown either blossoms or fruit. Tabulation therefore seems unnecessary and is omitted.

Since no varieties have yet fruited here, lists of varieties for planting can not be predicated upon the experience here; but, acting in the light of earlier experience, there seems no occasion to modify the recommendations of last year, which were as follows:

For a succession of varieties of high quality, named as nearly as practicable in the order of their ripening: Summer Doyenne, Giffard, Bloodgood, Tyson, Rostiezer, Clapp's Favorite, Howell, Bosc, Anjou, Winter Nelis, Dana Hovey, and Pound, the last for culinary use only.

For smaller plantations the following will afford a partial succession of vigorous, productive varieties, of fair quality:

Summer Doyenne, Clapp's Favorite, Bartlett, Sheldon, Howell, Onondaga, Anjou, and Lawrence.

For a market list affording a succession: Summer Doyenne, Tyson, Sterling, Clapp's Favorite, Bartlett, Howell, Onondaga, Bosc, Anjou, and Lawrence.

The varieties named have all been a long time before the public, and are believed to be so well and generally known as not to require description.

APPLES—*Pyrus Malus.*

Of apples, the number of varieties planted during and prior to the spring of 1891 is as follows:

	No. of varieties.
In 1888	34
In 1889	4
In 1890	88
In 1891	14
Total	140

Of which but one variety, Keswick, has yet shown either blossoms or fruit, this having fruited in 1890 on a two-year-old rootgraft, and again in 1891 upon the same tree, which was at the same time in vigorous, growing condition.

There are yet on the southeast block, intermediate between the plantations of pears and apples, ninety-eight vacancies to be filled with either pears or apples as shall be found most desirable. There is also room on the northeast block for an intermediate row of twenty-four trees which may be filled with either apples or pears; and a similar one in the northwest block with space for thirty-three trees; with space for another, also, between apple rows for thirty-three trees.

Of insects the green aphis, *Aphis mali*, appeared in increased numbers this season and, owing to the circumstance that resort must be had to acrid or corrosive substances as effective remedies, and that their strength must be such as to prove fatal to the aphides, and yet not injurious to the foliage, it proved difficult, if not impracticable, to so graduate their strength as to fully exterminate the pests by a single application. By repeating applications, however, the enemy was kept well in subjection, and finally disappeared altogether.

A young tree or two of the Russian varieties, received from Prof. J. L. Budd of Ames, Iowa, were attacked slightly by blight of the young twigs, due doubtless to bacteria. These were at once cut away and burned. Aside from this, the apple has been free from attacks of fungus in any form; and with the generally cool season, the growth has been moderate and healthy.

No varieties (save the one already mentioned) having yet come into bearing, tabulation seems unnecessary, and is omitted.

The following list of varieties is selected for a family orchard, to supply dessert, culinary, and sweet varieties in succession, from early August till the opening of the small-fruit season, naming them, as nearly as practicable, in the order of maturing.

Early Harvest.
Sweet Bough.
Jeffries.
Munson Sweet.
Shiawassee.
Northern Spy.
Early Strawberry.
Garden Royal.
Keswick.
Dyer.
Hubbardston.
Lady Sweet.
Primate.
Jersey Sweet.
Rhode Island Greening.
Golden Russet.
Chenango.
St. Lawrence.
Jonathan.
Talman Sweet.
Roxbury Russet.

The following market varieties will afford a succession, for a local market, for a similar period.

Early Harvest.
Lowell.
Rhode Island Greening.
Roxbury Russet.
Red Astrachan.
Shiawassee.
Baldwin.
Maiden Blush.
Hubbardston.
Red Canada (top graft).

Descriptions are not deemed necessary, since nearly all are old, well-known varieties; while their arrangement in the order of ripening will, at least approximately, indicate the season of each.

QUINCES—*Cydonia*.

Of these the varieties and dates of planting are as follows:

Number.	Name.	Planted.	Bloomed.	Ripened.
1	Alaska	1891		
2	Angers	1890		
3	Champion	1888	May 28	Oct. 25.
4	Fuller	1891		
5	Hong Kong	1890		
6	Meech	1888	June 1	
7	Missouri Mammoth	1890	May 24	
8	Orange	1888	" 30	Oct. 10.
9	Rea	1888	June 1	" 15.

Champion (not on station), for several seasons failed to fully ripen its

fruit here; but for the last two seasons, it has done this, and matured fine specimens. It shows a manifest tendency to over-production, and must be severely thinned as a preventive. The foliage is beautifully glossy and healthy; but the young shoots are so liable to blight that constant watchfulness and severe cutting have proved necessary in the case.

The other varieties have, so far, proved to be free from blight, and few if any cases of the red rust, *Roestelia aurantiaca*, have appeared this season.

The spot or scab *Morthiera Mespili* upon the foliage, so injurious last year, has proved equally so during the current season. The visitations so far have been mostly, if not wholly, confined to the orange quince which apparently from this cause have, in several cases, made very feeble growths

NUTS.

CHESTNUT—*Castanea Vesca.*

Of chestnuts the following have been planted: Hathaway is a very large variety of our native chestnut, originated by B. Hathaway of Little Prairie Ronde, Michigan. Two root-grafted plants received from him in 1890, and carefully planted, made a rather feeble growth during the succeeding summer, and were obviously still living on the opening of the spring of 1891; but one of them failed to start and the other, after a feeble effort, also died.

Seeds from the original tree, which had been bedded in earth through the winter, were also sent me, and were duly planted. Several of those have done well and are now well-established plants. It is not, however, to be expected that they will, with certainty, transmit the characteristics of the parent.

Japan, grafted; Japan, home grafted; Japan, imported grafted; Japan Giant; Japan Seedling, and Japan Sweet, are alleged varieties of this family, obtained from different sources during 1890 and 1891.

Paragon (which is now known to be a seedling from the European or Spanish chestnut) was planted in 1888, and has now produced fruit for two successive seasons, which, we regret to say, has, in both cases, proved abortive; possibly, if not probably, for the reason so frequently given, that the pollen matures and falls before the pistils become receptive, there having been no other fruiting tree in the vicinity.

Spanish chestnut trees were also procured and planted during the spring of 1890, which are in growing condition.

CHINQUAPIN—*Castanea pumila*—Dwarf Chestnut.

Recognizing the difficulty of transplanting this, seeds were procured from Tennessee in the autumn of 1889 and planted at once, but all failed to vegetate the next spring. During a visit to Washington in September last, we gathered a few ripe nuts from the adjacent forests of Maryland, which, on my arrival at home, were at once imbedded in earth to be planted next spring, hoping, between this and the possible procuring of rooted plants at planting time, to be able to start plants for trial.

PECAN—*Hickoria olivæformis.*

This, in common with most, if not all the genus, is difficult to transplant. Trees were planted in the spring of 1888 which, failing, fresh nuts, the growth of that year, were obtained from near the northern limit of this fruit, in southeastern Iowa, in late autumn, and planted at once, where the trees were to stand. These vegetated freely in the spring of 1889 and have since made slow but healthy growth, though left through successive winters without protection.

A few of what are known as Paper-Shell Pecans, of Texan growth, were received last autumn through the National Division of Pomology, and imbedded in sand preparatory to being planted the coming spring, as a means of comparing the relative hardiness of trees grown from northern and southern seed.

WALNUTS.

ENGLISH WALNUT OR MADERIA NUT—*Juglans regia.*

Two trees of this were planted in the spring of 1889, one of which failed and was replanted the following spring. The two are yet in growing condition, though not growing strongly.

Præparturiens (a dwarf variety of the foregoing) was planted in the spring of 1890, coming safely through the past winter.

JAPAN WALNUT—*Juglans Seiboldi.*

Trees of this were planted in the spring of 1890, and came through the past winter uninjured. They have made a vigorous growth so far, giving promise of ready adaptation to our soil and climate.

RHUBARB—*Rheum Rhaponticum.*

No additions have been made to this plantation since it was planted.

The purpose in selecting the varieties was to compare the relative earliness of the varieties, and the general desirability for culinary uses.

The Early Scarlet and Early Crimson can scarcely be said to be earlier than Linnæus, which has so long stood at the head of the list, so far as popular preference is concerned.

Whether any of these varieties are to be preferred for forcing, or other similar purpose, has not been made the subject of investigation.

So far as size, quality, and productiveness are concerned there is apparently little occasion to look beyond the Linnæus.

ASPARAGUS—*Asparagus officinalis.*

Of asparagus six named varieties, twelve plants of each variety, were planted in the spring of 1890.

Owing to the diœcious character of the plant, it seems questionable whether a variety, according to the usual signification of the word, is possible, except in an accommodated sense, as the result of continuous selection, for the development of a special type or strain.

The trial and comparison so far indicates few if any differences between the six alleged varieties planted, except in the single case of the Palmetto, which produces decidedly larger and taller shoots than either of the other

five varieties, with also a somewhat distinctive color—differences which may have been the result of the process of selection; or, by possibility, the outcome of continuous cultivation in a particularly favorable climate—one or both.

One variety, the Argentueil, was duplicated, a dozen seedling plants, and a dozen crowns from an older bed, having been set, for the purpose of comparing their relative success; and for the further purpose of determining whether the sexuality or seed-producing quality is constant, or liable to vary in different seasons.

All which is respectfully submitted.

T. T. LYON,
Agent in Charge.

So. Haven, Mich.,
Dec. 31, 1891.

VEGETABLE TESTS.

Bulletin No. 79, January, 1892, Agricultural Experiment Station.

During the season of 1891, considerable attention was given to testing novelties sent out by seedsmen. Many of these varieties were very highly praised, and it seemed desirable that the public be informed of their merits or demerits, without being compelled to purchase the hundreds of varieties that have been sent out during the past one or two years. Most of them are sold at a high price, and this, added to the labor of growing them, would be an expenditure that few persons would care to make, especially as a majority of the varieties would be likely to prove of less value than some of the older kinds. Many of the novelties, however, are of real value, and we have endeavored in this bulletin to give them such recommendation as they deserve.

BUSH BEANS.

Thirty-five varieties were planted on the 25th day of May. Two hundred beans were planted in a space ten feet long, with three feet between rows. After the per cent. of vegetation was noted, the varieties were thinned to sixty stalks each. In the following table not all of the varieties grown are included. A few of the best of each class of the older sorts, and the novelties obtained from the different seedsmen are given.

TABLE I.

Number.	Variety.	Seedsman.	No. of days to vegetation.	Per cent of vegetation.	No. of days to bloom.	No. of days to edible maturity.	No. of days to ripening.	Yield of pods from sixty stalks.	Weight of shelled beans, in ounces.
1	Aroostook	Jerrard	10	29	39	57	84	425	11.62
2	Best Dwarf	Burpee	8	68	42	64	98	447	9.44
3	Blue Podded Butter	Burpee	8	70	42	60	84	321	10.02
4	Burlingame	Maule	7	71	46	67	85	675	19.83
5	Challenge	Ferry	10	38	42	56	84	332	14.00
7	Cylinder Black Wax	Henderson	10	25	42	58	95	456	13.04
8	Dakota Soup	Maule	8	84	39	57	95	400	15.00
10	Detroit Wax	Ferry	12	46	42	57	98	298	13.92
13	Flageolet Wax	Henderson	11	51	42	56	95	313	12.69
14	Golden-eyed Wax	Henderson	9	63	39	56	85	419	11.37
15	Mammoth Wax	Henderson	10	31	42	55	95	306	13.65
21	No. 2½	Hatt	7	79	47	66	87	389	19.40
22	No. 3	Hatt	10	37	46	66	103	477	15.00
23	Osborn Forcing	Henderson	12	11	47	59	98	724	27.14
28	Refugee	Johnson & Stokes	8	79	42	58	85	573	18.10
29	Ruby Dwarf Horticultural	Rawson	11	76	55	66	108	439	15.28
31	Saddleback	Landreth	7	48	37	56	95	525	16.41
32	Shah	Thorburn	7	89	55	66	95	580	19.50
33	Snowflake	Gregory	8	67	54	66	95	675	15.32
34	Speckled Wax	Ferry	8	87	55	65	95	448	19.32
37	Warwick	Henderson	8	98	38	56	87	419	25.52
38	White Valentine	Henderson	8	79	42	58	87	538	21.81
40	Yosemite	Gregory	9	70	39	58	108	460	13.33
42	Gold Dot	Hicks	7	87	37	55	87	490	18.95
43	Queen Wax	Hicks	7	86	37	55	87	398	17.45
44	Golden Eye Wax	Rice	9	48	46	59	87	352	22.94

WAX SORTS.

Cylinder Black Wax—Hend. Growth strong, many branched, healthy; pods light yellow, almost white, flesh solid, tender, excellent quality. It is productive, matures its pods in succession, and they remain long in edible condition. A most valuable variety for family use.

Saddleback—Landreth. Growth medium, somewhat spreading; pods rich golden-yellow, two and one half to three inches long, curved, round, solid flesh. Early and productive.

Detroit Wax—Ferry. Growth strong, erect, healthy; pods long, broad, tender and of good quality. An excellent variety..

Flageolet Wax—Hend. Growth strong, erect; some appearance of fungus on foliage and pods; pods yellow, five to six inches long, largest at apex. Productive.

Yosemite—Greg. Growth spreading, many branched; pods yellow, round, four to five inches long. Flesh tender, thick and solid. Productive. A good bean.

Mammoth Wax—Hend. Growth strong, healthy; pods large, flesh solid, tender, with no string. It is early, fairly productive, and bears its pods in succession. An excellent variety.

GREEN SORTS.

Dakota Soup—Maule. Growth medium, upright; pods green, three to

four inches long, narrow, tender, excellent quality and grow in succession.

Best Dwarf—Burpee. Growth large, healthy; pods green, tender, good quality, no string. Productive.

No. 3—Hatt. Growth tall, spreading; pods very tender, and excellent quality. A rather late variety, but productive and affording a succession of edible pods for a long season. Not affected with rust.

FIELD SORTS.

Aroostook—Jerrard. Growth small, healthy; bean rather small, round, excellent quality. Early and productive.

Burlingame—Maule. Growth large, spreading; bean large, white. Very productive.

No. 2 1-2—Hatt. Growth large; stalks long, reclining; bean of medium size, white. Pods all mature together. Productive.

Snowflake—Greg. Growth medium; stalks stout with many slender branches; bean small, round, white; excellent quality. Productive.

NEW VARIETIES.

Challenge—Ferry. Growth low, stout, vigorous; pods golden-yellow, four to six inches long, round, curved; good quality. With us it was not as early as claimed by introducers.

Osborn Forcing—Hend. Stalks very large, stout, of upright growth; pods green, five to six inches long, nearly all mature at the same time, and remain a considerable period in edible condition. Bean yellow-brown, with lighter markings. It was the most productive variety grown. It was not tried as a forcing bean, but it is certainly a good out-door variety.

Ruby Dwarf Horticultural—Rawson. Growth vigorous; stalks slender, trailing; pods green, two and one half to three inches long, broad, flat, usually twisted sidewise, tender, excellent quality. The introducers claim that the pods are of a very dark ruby color. The plants grown by us did not show this characteristic.

Shah—Thorburn. Growth very vigorous, erect; pods green, five to six inches long, narrow, straight, tender and of excellent quality. Productive. Season medium. Excellent for succession.

Speckled Wax—Ferry. Growth strong, healthy, erect; pods greenish-yellow with small streaks of purple, nearly straight, very tender, without string, good quality, borne in succession. Season rather late. An excellent bean for the family garden.

Warwick—Hend. Growth large, erect, many branched; pods green, three to four inches long, straight, mature together; do not remain long edible. Productive. Early.

Gold Dot—Hicks. Of vigorous, upright growth; pods golden-yellow, broad, thick, straight, three to five inches long, tender, good quality. Early. Productive. The bean varies much in color and form. The variety is not fixed.

Queen Wax—Hicks. Much like preceding in plant and pod. Evidently a selection from Golden Eye Wax.

Golden Eye Wax—Rice. Growth medium; pods golden-yellow, four to five inches long, slightly curved, tender, good quality.

The following short list of varieties will prove satisfactory to growers:

Wax beans—Cylinder Black Wax, Speckled Wax, Saddleback and Mammoth Wax.

Green-podded varieties—Osborn Forcing, Dakota Soup, Hatt No. 3 and Shah.

For field culture—Burlingame, Snowflake and Hatt No. 2½.

POLE BEANS.

Eleven varieties of pole bean were planted June 3. The rows were six feet apart, and the poles were placed four feet apart in the row. The following table shows the comparative vegetative vigor and earliness of the several varieties.

TABLE II.

Number.	Variety.	Seedsman.	No. of days to vegetation.	Per cent. of vegetation.	No. of days to bloom.	No. of days to edible maturity.
2	Challenger	Thorburn	11	5	82	127
3	Ford Mammoth	Henderson	10	8	55	125
4	Golden Champion	"	8	89	51	76
5	Golden Cluster	"	8	70	61	82
7	Jersey	"	11	16	82	------
8	Old Homestead	"	8	90	50	78
9	Scarlet Runner	"	8	85	49	121
10	Willow Leaf	Burpee	10	15	68	111
11	Horticultural Lima	Hicks	8	98	49	75
12	White Zulu	Burpee	8	74	55	80

Challenger—Thorburn. Plants are of vigorous, healthy growth; pods two and one half to three inches long, broad; beans large, thick, good quality. The plant continues to form pods until frost. The beans are late in becoming edible. One of the best of the pole Limas.

Ford Mammoth—Hend. Of vigorous, healthy growth; beans very large and of excellent quality. Plants productive. An excellent climbing Lima.

Golden Champion—Hend. New. Plants of low growth, three to four feet high; pods light yellow, almost white, round, curved, four to five inches long, thick, tender, and good quality. Productive. The earliest wax pole bean grown this season.

Golden Cluster—Hend. Plants are very vigorous, climbing to the tops of the poles eight to ten feet high; pods golden-yellow, six to nine inches long, thick, very tender and of the best quality; vines very productive, bearing pods from bottom to top of poles.

Jersey (Lima)—Hend. Plants vigorous. The vines were killed by frost before the beans were edible.

Old Homestead—Hend. New. Vines vigorous, running to the tops of the poles; pods six to nine inches long, round, curved, and twisted, green, very tender and of best quality. Productive. Early. An excellent snap pole bean.

Scarlet Runner—Hend. Of vigorous growth; pods four to five inches long, broad, dark green, rough, good quality as a string bean. The beans are also good for cooking. Productive, but late in maturing pods. It is

very ornamental, producing its bright scarlet flowers throughout the season.

Willow Leaf—Burpee. Growth low, slender, leaflets long, very similar to the leaf of a willow; pods short, broad, bean of medium size. The plant lacks growth and productiveness.

Horticultural Lima—Hicks. New. Growth medium; pods four to five inches long, broad, nearly straight, green, dotted with light purple. The pods are borne low down on the poles. Good as a string bean and the earliest of the Limas.

White Zulu—Burpee. New. Growth medium to strong; pods five to eight inches long, broad, flat, light green, nearly white, tender, and of good quality. Some vines are more productive than others, and the pods vary considerably in form and color. The variety is not fully fixed.

BEETS.

Twenty varieties of beet were planted May 6. After vegetation they were thinned to six inches apart. The varieties grown for foliage alone are not given in table.

TABLE III.

Number.	Variety.	Seedsman.	Number of days to vegetation.	Per cent of vegetation.	Number of days to edible condition.
1	Arlington	Henderson	17	36	81
3	Bassano	Landreth	22	14	84
4	Blood Turnip	"	27	10	71
6	Eclipse	"	17	54	69
7	Edmands' Blood Turnip	Ferry	19	41	84
8	Egyptian	Landreth	20	27	64
9	Faust's Early	Gregory	25	14	77
10	Half-long Blood	Landreth	24	73	94
11	Landreth Early	"	17	59	69
12	Lentz	Henderson	17	58	69
13	Long Blood	Landreth	17	50	97
14	Reine des Noires	Henderson	18	62	94
15	Salzer Beauty	Salzer	20	36	81
20	Sample No. 4	Burpee	17	68	69

Egyptian. Very early; form round, flattened at top and bottom; flesh dark red. Not so desirable after later varieties can be obtained.

Bassano. Tops large, valuable for greens. Particularly desirable for home use.

Blood Turnip. Medium early, regular form, flesh dark scarlet, firm, good. One of the best for family use.

Eclipse. Tops medium; form round, tapering; flesh dark purple with narrow white rings, firm, excellent quality. Early.

Edmands' Blood Turnip. Tops large; form regular, round; flesh very dark, firm; later than Blood Turnip. An excellent variety.

Half-long Blood. Tops medium to large; diameter two and one half to three inches, length four to six inches; flesh dark purple, firm, juicy. Excellent for market or to store for winter use.

Long Blood. Tops large; root ten to twelve inches long, two to three inches in diameter, regular form; skin smooth. A good late variety.

Salzer Beauty. Tops medium; roots three inches long, diameter three inches, very regular form; smooth skin, and highly colored flesh. A valuable variety.

The following varieties are of recent introduction:

Arlington—Hend. Tops quite large; roots, three to four inches in diameter; length, four to five inches, regular form; skin smooth; flesh white, with pink-scarlet rings, firm and of good quality. Does not become tough and stringy.

Faust's Early—Greg. This variety did not prove to be as early as claimed by the introducers, and the flesh was mostly white. Nothing special to recommend it.

Landreth Early—Land. Tops small, compact; root good size, regular form; flesh light, but very firm and brittle. Early. An excellent variety for forcing or early garden use.

Lentz—Hend. Tops small, root-diameter four inches, length four inches, with long tap root, good form; flesh dark scarlet with light rings. Early. Excellent.

Reine des Noires—Hend. Tops medium size; leaves dark purple, handsome; root long, tapering, usually curved; flesh dark blood red, excellent quality. A good late variety.

Sample No. 4—Burpee. Not yet introduced. Tops medium size; root round, with tap root long; flesh very dark purple, with lighter rings, firm, good. Early. A good beet.

CELERY.

Golden Dwarf. This is the variety generally grown in the Kalamazoo district. It is solid, of excellent flavor, and one of the best keepers during the winter.

White Plume. A dwarf variety requiring little banking to bleach. The bunches are large; stalks of a golden-yellow color, solid, tender, and good quality. Early and a good keeper.

Golden Self Blanching. This variety requires little banking to bleach. The stalks are somewhat larger than the White Plume, of a rich, golden color, crisp, excellent flavor. One of the best varieties grown.

Half Dwarf. A medium-growing variety requiring care to blanch well. Has a decided nutty flavor. A good variety.

Heartwell. A strong growing variety with broad, thick stalks. Quality fair. Not so suitable for general growing as the smaller sorts.

Large Solid. A tall-growing variety requiring much earthing. Late.

Rose. A medium growing variety; stalks of a rosy red color. Excellent quality, not stringy, and a good keeper. Late.

Pascal. New. A medium-growing variety, blanching well; bunch large; stalks are very thick and solid and of excellent quality. A very promising variety.

CUCUMBERS.

The following is a brief description of the varieties grown during the season:

Cluster. Vines of short, close growth; fruit three to five inches long,

diameter two to three inches, smooth, nearly round; flesh solid, excellent. Lacks productiveness.

Everbearing. New. Vines of short growth; fruit four to six inches long, diameter two to three inches, smooth. Early. Vines fairly productive, and continue to produce fruit for a long season.

Green Prolific. Vines healthy, strong-growing and prolific; fruit five to seven inches long, diameter two to three inches; flesh firm, good. One of the best varieties grown.

Long Green. The popular and reliable variety for pickling.

Parisian Pickling. Vines are of short growth, productive. Fruit when fully grown ten to twelve inches long, diameter one and one half to two inches, densely covered with fine prickles; flesh firm and tender. The fruits when young are long and slim. Excellent for pickling.

Pera. Vines vigorous, fairly productive; fruit good size, nearly white. A good variety for table use.

Russian. Growth close; fruit small, good form. Very early and excellent for pickling. Productive.

White Japan. Vines vigorous, healthy, spreading well; fruit large, good form, excellent quality, white. A very handsome cucumber and the vines are productive.

White Spine. Vines very strong and vigorous; fruits large, regular form, light green color. Productive. One of the best for table use.

Hill's Forcing White Spine. A selection from White Spine. Fruit large, of even size, dark green color; flesh solid and of good quality. Productive. An improvement over White Spine.

The following are recommended for the purpose named:

For pickling—Green Prolific, Long Green, Russian, Parisian, and Everbearing.

For table use—Hills' White Spine, Pera, and White Japan.

EGG PLANT.

This is a tropical plant, and owing to its tenderness and the difficulty of getting strong, well-grown plants to set out, its culture is not always successful. The plants should be started in hot-beds from the 15th to 20th of April. The temperature should not fall below 70°. They should not be set out until the weather is warm and settled, about June 1 to 10. Set in rows three feet by two feet. If good plants are set out their after culture is not difficult. New York Improved and Black Pekin are the best varieties to grow.

LETTUCE.

About thirty varieties have been grown during the year. Varieties have been tested in the forcing-house, in hot-beds, and in the garden. For the forcing-house we have found nothing better than Grand Rapids. It is a strong, upright grower, of attractive appearance and free from rot. Chicago Forcing is an excellent variety for the purpose, but requires better care than Grand Rapids to do well. White Tennisball, Boston Curled, Hot-house, and Golden Queen are also good forcing lettuces.

As a remedy for the aphis, we found that a table-spoonful of *good* pyrethrum dissolved in a bucket full of water, applied in a fine spray with a force pump, was very effectual in keeping down this pest.

For hot-bed purposes, Chicago is a superior variety. Tennisball, California Butter, Hanson, Simpson, Golden Queen, Hot-house, and Landreth Forcing will do well.

The following table shows the comparison of varieties grown out of doors. The plants were grown in the forcing-house, and were transplanted to the open ground May 15.

TABLE IV.

Number.	Variety.	Seedsman.	Number of days to vegetation.	Per cent of vegetation.	Number of days to maturity.	No. of days to starting of seed stalk.	Number of days to bloom.	Number of days to seed ripe.
2	Bath Cos.	Rawson	6	76	38	45	74	102
3	Big Boston	Henderson	6	93	31	38	67	97
4	Black Seeded Simpson	Rawson	6	81	38	46	102	114
5	Black Seeded Tennis ball	Rawson	5	93	36	39	65	97
6	Boston Curled	Rawson	6	91	34	40	73	101
7	Boston Market	Rawson	6	82	22	35	64	90
8	California Butter	Rawson	6	76	36	43	74	102
9	California Mammoth	Maule	6	89	43	49	80	102
10	Chicago	Vaughan	8	71	26	31	64	97
11	Curled India	Landreth	7	71	38	49	74	99
12	Deacon	Rawson	5	92	41	51	80	102
13	Denver Market	Henderson	5	87	36	56	97	123
14	French Blockhead	Thorburn	5	91	38	54	82	102
15	Golden Queen	Henderson	7	58	34	38	97	123
16	Grand Rapids	Gregory	7	73	40	52	82	133
17	Green Fringed	Landreth	7	62	40	55	101	123
18	Hanson	Rawson	6	89	38	52	82	102
19	Hot-house	Rawson	6	78	21	26	67	95
20	Landreth Forcing	Landreth	6	82	36	40	67	102
21	New York	Henderson	6	84	38	46	76	102
22	Oak Leaved	Rawson	7	92	42	56	97	123
24	Sunset	Salzer	7	70	38	54	101	123
25	Tomhannock	Rawson	7	87	34	45	67	97
26	White Star	Ferry	6	94	36	49	96	118
27	Year Round	Rawson	8	49	34	40	74	97
28	Cabbage	Vaughan	7	33	38			
29	Long Standing Cos.		8	86	52			

For summer varieties of the older sorts, Hanson, Simpson, Grand Rapids, Tennisball, California Butter, Tomhannock, and Chicago are all good.

The following are new varieties:

Big Boston—Hend. Very similar to Boston Market, but it forms larger heads of close, compact form. The leaves are tender and of excellent quality. The type is not fully fixed.

Denver Market—Barteldes. The leaves are large, very closely curled and waved, of a light yellow-green. It forms a rather loose head. Tender and excellent quality, but the edges of leaves are turned brown by the sun.

Golden Queen—Hend. Leaves light yellow-green. It forms very compact, small heads of the best quality. It can be planted very close. A forcing variety, not good in the garden.

Hot-house—Rawson. Leaves dark green with outer edge purple. It forms a good-size, compact head containing a large amount of lettuce. It is free from rot. A very desirable forcing variety.

New York—Hend. Leaves large, dark green, finely wrinkled and with closely cut edges. It forms a large, firm head which stands long and

endures the sun well. It is a distinct type and a valuable summer variety.

White Star—Ferry. Of the Hanson type, but the leaves are more wrinkled and curled. It forms a large, loose head of the best quality. An excellent variety.

Cabbage—Vaughan. Not yet introduced. Leaves dark green, smooth, edges entire; inner leaves have purple edges. It forms a close head, tender and of excellent quality. A good variety.

PEPPERS.

The peppers were sown in flats in the forcing-house on the 18th of March, and were transplanted out doors June 9.

TABLE V.

Variety.	Seedsman.	Number of days to vegetation.	Per cent of vegetation.	Days to edible condition from transplanting.	Number of days to ripening.
Brazilian	Thorburn	22	38	89	114
Cardinal	Ferry	21	69	72	89
Chili	"	26	59	79	88
Coral Gem	Thorburn	26	78	--------	77
Dawn	Ferry	25	69	68	85
Large Bell	"	28	60	62	79
Long Red	"	26	71	70	89
Mountain	"	28	75	68	--------
Ruby King	"	26	55	66	79
Squash	"	26	45	62	76
Black Nubian	Childs	27	76	72	76
Childs' Kaleidoscope	"	29	56	89	--------

Cardinal and Long Red have long tapering fruits, bright red or scarlet; flesh of mild flavor. Chili and Coral Gem have small tapering fruits of pungent flavor. Large Bell and Ruby King have large, short fruits of dark red color; flesh thick and of mild flavor. The Squash pepper is nearly round, smooth, mild flavor. It is very productive and free from rot. The following are recent sorts:

Brazilian—Thor. Plants of large, strong growth; fruit one and one half to one and three fourths inches in diameter, four to five inches long, irregular shape; color variegated. Very tender and too late in maturing fruit for this section.

Black Nubian—Childs. Plant of slender, spreading growth; fruit borne upright, two to three inches long, one inch diameter at base, tapering slightly to apex; color blue-black; mild flavor. Productive.

Childs' Kaleidoscope—Childs. Plants of strong, spreading growth; fruit one inch in diameter at base, and one inch long, tapering to a point, slightly ribbed; color dark yellow, changing to bright scarlet. An ornamental plant.

RADISHES.

Varieties of radish were tested in the forcing-house, in hot-beds, and in the garden.

Forcing radishes. Many early radishes sent out by seedsmen under various names differ but slightly in form or shade of color. Olive, Deep Scarlet Short Top, French Breakfast, Scarlet Turnip, Round Dark Red and Scarlet Button are excellent for the purpose. Wood Frame is nearly as early as any of the above and the roots are much larger and longer.

The following are forcing sorts recently introduced:

Rapid Forcing—Hend. Tops small; root round, light scarlet, white tipped. A good variety but scarcely as early as claimed.

White Globe—Faust. Tops large; root round, sometimes olive-shaped; skin white; flesh firm, mild flavor. A good white variety.

New Champion—Faust. Tops small; root round, tending to oblong; skin bright scarlet; flesh tender and of excellent quality. This variety came to maturity four days earlier than any other grown this year.

Acme—Salzer. Tops small; root short, olive-shape; color dark scarlet; flesh crisp, tender. A good variety.

Non Plus Ultra—Ferry. Tops small; root round, bright scarlet; flesh tender, crisp. Early. Excellent for forcing.

The following table shows the comparison of the radishes grown in the garden:

TABLE VI.

Number.	Variety.	Seedsman.	Per cent of germination in 4 days.	Total per cent of germination.	Number of days to vegetation.	Per cent of vegetation.	Days to edible maturity.	Days to seed-stalk starting, from maturity.
1	Acme	Salzer	25	80	17	41	36	14
2	Black Spanish	Henderson	86	93	17	74	80	--------
3	Blood Turnip	Gregory	93	95	17	77	41	9
7	Chartier	Ferry	50	65	18	33	46	13
8	Chinese Rose	Henderson	--------	--------	16	48	46	8
9	French Breakfast	Ferry	2	86	16	57	36	30
10	Garnet	Landreth	98	100	16	28	34	12
11	Golden Globe	Ferry	44	60	15	38	46	8
12	Non Plus Ultra	"	63	85	19	44	34	22
14	Rapid Forcing	Henderson	71	71	19	38	34	42
15	Round Scarlet	Ferry	--------	81	19	34	41	27
16	Sandwich	Henderson	64	97	19	51	48	--------
17	Scarlet Globe	Ferry	85	91	18	61	41	15
18	Scarlet Olive	"	60	76	16	39	41	15
19	Scarlet Short Top	Faust	72	100	15	35	42	14
21	Scarlet Turnip	Ferry	16	92	16	67	38	18
22	Surprise	Burpee	67	83	16	64	48	20
24	White Olive	Ferry	4	78	18	37	38	27
25	White Spanish	Henderson	54	89	14	47	44	8
26	White Summer	Ferry	91	96	14	56	50	9
27	White Turnip	"	31	79	14	29	41	17
28	White Vienna	"	95	95	14	47	50	15
29	Wood Frame	"	48	68	14	26	41	17
30	Long Bright Scarlet	Vaughan	--------	--------	14	45	36	26
31	One-half Long, Bright Scarlet	"	--------	--------	14	26	42	24
32	China Round Scarlet	"	--------	--------	14	23	36	28

The following varieties are recommended for the purpose named:

Early radishes—Non Plus Ultra, French Breakfast, Wood Frame, Rapid Forcing, and Long Bright Scarlet.

Summer radishes—Chartier, Scarlet Short Top, Surprise, and White Summer.

Long Bright Scarlet—Vaughan. Not yet introduced. Tops medium to large; root one inch diameter, tapering, length four to five inches; color dark scarlet; flesh firm, excellent quality. The earliest long-rooted variety grown.

One-half Long Bright Scarlet—Vaughan. Not yet introduced. Tops small; root three fourths to one inch diameter, two inches long, olive-shaped, scarlet color.

SQUASHES.

Bay State—Greg. Eightto ten inches in diameter; six to eight inches long; color green, shell and meat thick. At the apex is an irregular projection. A good fall and winter variety.

Chestnut—Greg. Much like the Hubbard in form; shell white, hard; flesh yellow, good. Not very productive with us this year.

Cocoanut—Greg. Small, form round, conical; shell orange yellow with green tips; flesh fine grained and of good quality. Vines very productive. An excellent small squash for fall and winter use.

Sibley—Greg. Medium size, length eight to ten inches, diameter eight inches, tapering rapidly near apex; color pale green; flesh thick, dark orange color. Good for late fall and winter use. A very promising variety.

Ford Hook—Greg. An excellent winter variety for home use; too small for market.

Der Wing—Burpee. A small squash; skin creamy-yellow color, rough and warty; flesh light, fibrous.

TOMATOES.

The tomatoes under test the past year included nearly all of the distinct varieties from the previous year's collection, and such new sorts as we could obtain. The old kinds were many of them worthless, but were retained for purposes of comparison and illustration.

The number of plants of a variety used in the test was six. The seed was sown March 16, they were transplanted April 28, and placed in the field June 6. The vines were supported upon a wire trellis similar in construction to the one described in Bulletin 70.

The season was so cool that the date of ripening was from three to four weeks later than usual. As the fruits matured they were picked, counted, and weighed. The following table gives the results obtained from some of the newer and more valuable sorts upon six plants:

The Earliest from Vaughan was the first to ripen, and was one of the most productive varieties grown. It is medium in size, slightly angled or ribbed, yellowish-red in color, and moderately firm. On account of its extreme earliness, it is one of the most valuable sorts for early market purposes that we have ever grown.

Following it in a few days are Atlantic and Early Ruby; the former is the larger and more regular, but the Early Ruby is slightly earlier, and is more productive. Both are valuable sorts.

TABLE VII.

Number.	Variety.	Seedsman.	Ripe.	Number ripe fruits.	Weight, ounces.	Total weight fruit, ounces.	Average weight ripe fruit.
192	Red Mikado	Dreer	Aug. 22	208.5	1356.	2208.	6.
194	Shah	Henderson	Sept. 16	180.	996.	2544.	5.
195	Turner	Maule	" 23	46.5	702.	2274.	15.
196	Volunteer	Dreer	" 8	172.5	888.	2514.	5.
197	Nichol's Stone	Nichols & Shedd	" 8	147.	618.	2100.	4.20
198	Perfection	Livingston	" 8	202.5	808.8	1804.8	4.00
199	Haines	N. B. & G. Co.	Aug. 29	258.	1170.	2012.	4.53
200	Bay State	A. B. Howard	Sept. 16	208.5	828.	2220.	3.97
201	Atlantic	Johnson & Stokes	Aug. 19	166.5	966.	1926.	5.80
202	Brandywine	Johnson & Stokes	Sept. 8	118.5	661.2	2167.2	5.83
203	Cumberland Red	Johnson & Stokes	Aug. 19	285.	1536.	3282.	5.38
204	Ruby (Early)?	Henderson	Sept. 23	157.5	954.	2274.	6.05
205	La Crosse	Salzer	" 12	124.5	582.	1422.	4.67
206	Morning Star	Salzer	" 8	195.	1098.	2244.	5.63
207	Dwarf Champion	Maule	" 16	162.	760.8	1568.8	4.69
208	Perfect Gem	Salzer	" 12	180.	702.	2010.	3.90
209	Red Cross	Gregory	" 8	291.	1128.	2286.	3.87
210	Earliest of All	Salzer	" 8	342.	1464.	1902.	4.28
211	Station	Burpee	" 12	72.	180.	444.	3.33
212	Table Queen	Henderson	" 5	231.	1680.	2184.	7.27
213	Tree	Maule	" 29	33.	216.	444.	6.54
214	California Fig	Salzer	" 5	2237.	784.	1712.	.34
215	Chemin	Burpee	" 8	230.	880.	2484.	3.82
217	Long Keeper	Thorburn	Aug. 22	380.	1608.	2904.	4.23
218	Matchless	Burpee	Sept. 14	134.	672.	1952.	5.01
219	Mitchell	Gregory	" 8	269.	1316.	2516.	4.89
220	Stone	Livingston	" 16	138.	852.	2284.	6.17
221	Yellow Peach	Rawson	" 8	199.	412.	1196.	2.07
222	No. 400	Henderson	" 16	115.	1428.	2544.	12.50
223	Early Ruby	Henderson	Aug. 17	315.	1432.	2272.	4.54
224	Dwarf Champion	Harris	" 22	196.	816.	2000.	4.17
225	Potomac	Harris	" 30	253.	1340.	2512.	5.29
226	Nicholson	Nicholson	Sept. 8	497.	1316.	2292.	2.64
227	Optimus	Ferry	Aug. 22	297.	1208.	2496.	4.06
228	No. 1, Horner & Sons	Horner & Sons	" 22	230.	960.	1600.	4.17
161	Dead Ripe		Sept. 5	195.	960.	2514.	4.92
161	Green		" 5	209.	1008.	2496.	4.83

The Ignotum still holds its place at the head of the list as the best all-around tomato. It is very large, regular, solid, quite productive, and medium in time of maturity.

Of the new sorts, Long-keeper and Potomac of the pink kinds, and Cumberland Red and Mitchell of the red ones, gave best satisfaction. They seem to have no bad qualities and, in plant, size, shape, quality, and quantity of fruit, leave little to be desired.

The following notes upon some of the new sorts may be of interest:

214. California Fig—*Salzer*. Nothing more than the old Yellow Pear tomato, seeds of which can be bought for five cents per paper, while twenty cents is asked for the " New California Fig."

215. Chemin—*Burpee*. Fruits of medium size, spherical or slightly oblong. Very regular. Stem inserted in a cavity so small as to be hardly perceptible. Color light yellowish-red. Firm.

217. Long Keeper—*Thorburn*. Leaves much like those of Ignotum. Fruit pink, medium to large in size, round and flattened slightly, quite

regular, moderately firm; very productive. This seems likely to take the place of Beauty, which it much resembles.

218. Matchless—*Burpee.* In many respects this variety is similar to Ignotum but it is smaller, less productive, and not so even in size of fruit. It also lacks the shouldered appearance, and the solidity that distinguish that variety. Rather too late for this section.

219. Mitchell—*Gregory.* Very similar to Matchless in both fruit and plant, but as it was a week earlier it was nearly twice as productive of ripe fruits. The fruits are occasionally somewhat irregular, and show a disposition to crack around the stem. With selection it promises to become a valuable sort.

220. Stone—*Livingston.* Rather late for seasons like the last. Fruits very regular, quite large and solid. The best of the late varieties.

221. Yellow Peach—*Rawson.* Differs from the "Peach" tomato in being of a slightly yellow color. Excellent for canning and preserving.

222. No. 400—*Henderson.* Leaves large, something like Mikado. Fruits very large (from eight to twenty ounces), fairly regular, and quite firm. Season rather late. Very productive. If a very large, coarse tomato is desired the "400" should be selected.

223. Early Ruby—*Henderson.* Plants small, leaflets slightly curled. Fruits small to medium in size, red, slightly angled. Quite early and productive, but it is surpassed in both respects by Vaughan's Earliest, which is also fully as large and smooth.

224. Dwarf Champion—*Harris.* By far the strongest and best strain of this variety we have ever grown, evidently produced by careful selection. Plants stocky. Fruits large for the variety, very smooth. Quite productive.

225. Potomac—*Harris.* Plants of medium size, foliage dark green. Medium in ripening. Fruits large, very regular. One of the most productive kinds grown. In an ordinary season it would have been very near, if not at the head, of the list. A very promising variety.

226. Nicholson—*Wm. Nicholson, Framingham, Mass.* This variety is very highly esteemed by Mr. Nicholson for forcing purposes. Out of doors it is a very regular small to medium-size tomato, not perceptibly different from Advance. Quite productive.

227. Optimus—*Ferry.* A new strain of Optimus; seems to be well worth growing. Moderately productive, medium in earliness; fruits medium in size, quite firm, and of good quality. It is an excellent sort for home use or for markets that call for a red tomato of high quality.

228. No. 1—*Horner & Sons.* Plants quite small. Foliage somewhat wrinkled. Medium early. Fruits of medium size, fairly productive, flat, slightly ribbed, and angular. Not as valuable as many of the other sorts.

In order to see what the effect would be if seeds were selected from green fruits, we saved in 1890, seeds of Potato Leaf from half-grown green fruits, and from others that were dead ripe. They were planted and were given the same care. The results will be found at the bottom of the tomato table. It will be noted that there was no difference in the earliness, and that although the number of tomatoes that matured before the vines were killed by frost was the largest from green seed, the total weight of fruits green and ripe, and the average weight of the ripe fruits was the larger on the plants grown from ripe seed. There was little difference in the growth and appearance of the plants, although if anything those from ripe seeds were the stronger.

These results agree with those obtained in other experiments.

FERTILIZERS FOR TOMATOES.

In a field of the Earliest, plats were laid off for a test of various chemical fertilizers. The materials used were nitrate of soda, sulphate of potash, and dissolved bone-black. They were applied singly, and in various mixtures, so that we had each of them alone, with each of the others, and all three together. Alternate plats were left unfertilized, and that there might be no mistake, the experiment was duplicated.

The quantities of each used, whether together or separately, were 50 lbs. nitrate of soda, 100 lbs. sulphate of potash, and 200 lbs. dissolved bone-black.

The soil was a poor sandy loam which had been in grass for a number of years. Last fall it received an application of about thirty loads of stable manure per acre.

After the first two weeks the plants in the fertilized plats were slightly more vigorous than in those unfertilized. As the season advanced the difference became less marked, and at the time of ripening the plats could hardly be distinguished. There was no perceptible difference in the time of ripening or in the productiveness of the plats. In some cases the fertilized plats seemed to have larger and more regular fruits. This was particularly noticeable where the mixture contained the three combined.

From this experiment it would seem that where the amount used is not too great there need be no fear of loss in yield, and earliness from the use of fertilizers. On the other hand, where stable manure can be easily and cheaply obtained, the use of chemical fertilizers will not be profitable. Where manure can not be thus obtained, and where the land is not rich, the application of a mixture of 50 lbs. nitrate of soda, 100 lbs. sulphate of potash, and 200 lbs. dissolved bone-black per acre will prove profitable. If the land is very poor the amount can well be doubled.

TRELLISES FOR TOMATOES.

In order to determine what form of trellis, if any, was best, seven different kinds were put up for adjacent rows of the Ignotum. Two were constructed of wire; one had two wires one above the other to which the vines were tied. A second form consisted of four wires, two on each side of a six-inch fence board, and about a foot apart. The vines were allowed to grow up between these and hang over the top wires. The others were of wood; one form consisting of stakes five feet high, one to each plant, to which the main shoot of the vine was trained, the branches being allowed to hang down. A second form was made of strips of board four inches wide and six feet long. Two were used for each plant, the lower ends set in the ground two feet apart, and with the upper ends six inches apart, with three cleats on each side. A third kind was made by using three stakes with two barrel hoops to support the vines. Another had strips of wood instead of the hoops, and the last was much like the wire trellises, except that fence boards were nailed to each side of the stakes, instead of the wires.

There was no great difference in the efficiency of the different trellises, as all of them supported the vines. The four-wire trellis, however, was easiest to construct and required least attention in training the vines,

besides being neatest in appearence. The wires if galvanized will be almost indestructible and will last many years.

It will not pay in average years to trellis tomatoes for field cultivation, but it is often desirable in a small garden.

CABBAGES.

For the variety test thirty-eight varieties were grown. The seeds were sown Feb. 20 for the early and second-early sorts, and after being twice transplanted, the last time into three-inch pots, they were planted in the field on the 11th of May. They made a good start but many of them were attacked by the maggot, and of some kinds more than one half the plants were lost.

The following table shows the time of maturity and the average weight of the heads after being trimmed.

TABLE VIII.

Number.	Varieties.	Seedsman.	Total per cent germin. testor.	Per cent germin. in soil.	Time of vegetation, days.	Per cent of vigor 10 maxium.	No. of days to first head ripe from planting.	No. of days to market maturity from planting.	Number of heads.	Average.
1	All Head	Burpee	89	89	7	10	64	98	9	6.7
2	All Seasons	Gregory	85	73	7	9	77	89	9	6.1
3	American Savoy	"	73	68	8		131		10	5.12
4	Charleston Wakefield	Henderson	89	59	8	10	67	78	16	3.12
5	Chinese	Thorburn	100	94	7					
6	Deep Head	Gregory	73	56	8	10	98	106	17	8.4
7	Diamond Winter	"	75	59	8	10	110	137	18	10.10
8	Early Wakefield	Brill	100	90	7	8	64	77	12	3.5
9	" "	Gregory	84	56	9	7	58	74	16	3.6
10	Etampes	"	81	63	9	?	59	77	17	3.1
11	Flat Dutch	Brill	100	89	6	10	106	131	19	11.
12	Fottler's Brunswick	"	85	75	7	10	82	103	16	10.8
13	Hard Heading	Gregory	94	76	7	9	121	131	18	11.
14	Henderson's Summer	Brill	93	71	7	9	71	89	14	5.12
15	Louisville Drumhead	"	92	81	6	10	103	129	22	9.8
16	Marblehead	Gregory	90	75	8	9	137		15	8.12
17	Newark	Brill	58	48	8	10	59	82	12	4.9
18	Nonpariel	Gregory	84	41	11	8	78	98	12	2.7
19	Nonsuch	Brill	90	89	9	9	74		10	6.3
20	Paris	Gregory	91	86	7	9	59	78	15	3.14
21	Perfection Savoy	Brill	72	63	8	9	89	127	17	5.8
22	Premium Flat Dutch	"	83	59	7	10	110	131	14	11.8
23	Rothselburg	Gregory	98	82	7	10	72	89	17	4.9
24	Red Drumhead	"	97	80	7	9	101	141	15	7.12
25	Red Erfurt	"	86	88	8	9	110	137	8	5.3
26	Reynolds	"	85	77	7	8	82	98	6	6.5
27	Schlitzer	"	56	36	8	10	82	119	4	5.2
28	Succession	"	74	61	8	9	82	110	11	9.13
29	Volunteer	Rawson	96	81	8	10	57	67	8	2.8
30	Warren	Gregory	90	85	7	9	131	141	1	20.
31	World Beater	Brill	91	85	7	9	119		6	8.4
32	Yellow Dutch	Gregory	89	82	8	7	92	110	4	3.5
33	Luxemburg	Vaughan				9	110		11	8.15
34	New Dutch Winter	"				9			3	4.7
35	Savoy	"				10	110	137	7	15.4
36	Winter	"				9	112		14	8.4
37	Marvin's Savoy	"				10			23	5.
38	Vandergaw	"				9			23	7.14

EARLY VARIETIES, MATURING IN JULY.

Wakefields. Three samples of seed were obtained. No. 8 Early Wakefield—Brill, No. 9 Early Wakefield—Gregory, and No. 4 Charleston Wakefield—Henderson.

Nos. 8 and 9 have succeeded about the same during the season. No. 9 is earlier but smaller, and on the whole inferior to No. 8. The plants have been small, headed unevenly, and have not proved very desirable stock. No. 8 is on the whole better, more typically Wakefield, and noticeably superior to No. 9, larger and a trifle later.

Charleston Wakefield is more even in type than the others, and though a little later is much more desirable. The heads are more even in size, solider than 8 and 9. It is probably simply a carefully selected Wakefield stock, though in some points it resembles the Etampes. In keeping qualities in the field it excells 8 and 9 as it bursts less freely and lasts longer.

Etampes. This appears to be the best of the very early cabbages. It is of about the same season as the Wakefields, but it matures more rapidly, and is sooner out of the way for later crops. The heads are solid and compact and of convenient shape. The Volunteer—Rawson, is the Etampes under a different name. The same in time of maturing. No difference in any particular.

Paris. This seems to be but a later strain of Wakefield. The heads are not so solid, but are larger. On the whole it is inferior.

In general the Etampes are best for very early cabbages, as they are even, mature quickly, and are fairly solid. Some selected strain of Wakefield, as Charleston Wakefield, would follow in a few days, and fill in before the next later varieties.

SECOND-EARLY VARIETIES, MATURING DURING AUGUST.

Henderson's Summer and the Rothselburg seem to be identical. The heads are somewhat five-sided and very flat, easily distinguishable from others when the former is once known. They are very valuable. There was no difference in heading nor maturity between these kinds, and they appear the same throughout. The Henderson Summer appears heavier than the Rothselburg.

All Seasons and others of its type, differ from the above in being a little later, perhaps a week, and of different shape, more spherical but still much flattened. The heads are heavier and probably more solid. Of this type *All Seasons* and *Nonsuch* appear to be the best, but not very much superior to *All Head* and *Reynolds*. *Nonsuch* is a little uneven in maturing. If this could be bred out it would probably be the most valuable strain of the type. All Seasons is the best strain tested this year.

Fottler's Brunswick is the latest of this class to mature, coming to maturity this year from the 20th of August till September 1. They were fairly large, with very even, solid heads, true to type. There were no missing plants. They were the finest appearing of any of the cabbages, regardless of type or class.

SEPTEMBER CABBAGES.

Hot weather the last of September matured these earlier than usual and

many cabbages burst. Of this class the *Diamond Winter* is probably the most valuable though very little better than the *Flat Dutch*, which is larger but seems less solid and compact in habit.

Hard Heading (*Luxemburg*) is of the same practical value as *Flat Dutch* but more spherical in shape and somewhat uneven and untrue to type. *Louisville Drumhead* and *Premium Flat Dutch* are practically identical with Flat Dutch.

Of this class of cabbages the Diamond Winter and Flat Dutch are most desirable, owing to the regularity and solidity of heads, and freedom from bursting.

OCTOBER CABBAGES.

Marblehead and Vandergaw were well selected strains and the best of this class. *Winter* was smaller but still very desirable.

Of the Savoys, Marvin's was much the best, as was the Red Drumhead in its class.

NOTES ON SOME OF THE NEW VARIETIES.

Hard Heading—Gregory. Practically the same as Luxemburg, although a better selection than that variety from Vaughan. Stem short; leaves light green, spreading two and one half feet; heads nearly spherical, slightly flattened on top, very solid. Said to be an excellent keeper.

Newark—Brill. (*Newark Early Flat Dutch.*) Plants very even and vigorous. Stem short and small. Leaves spreading, two feet across, bluish-green with yellowish veins. Heads quite solid, flattened. About a week earlier than Henderson's Summer, to which it is preferred by some.

Nonpariel—Gregory. Stem very short and small, head rather loose, nearly spherical, rather small. Less valuable than several other sorts of the same period.

Nonsuch—Brill. Stem quite short; leaves bluish-green, very large and spreading; heads large, flattened, very solid. Ripens with Henderson's Summer. A valuable second-early variety, but it can be improved by careful selection.

Schlitzer. Stems quite long; outer leaves loose, scattered, upright, bluish-green; heads nearly spherical with slight points, size medium, solid. Quite a sure header and excellent in quality.

Warren. (*Stone Mason.*) This variety suffered badly from maggots, and only one plant escaped them, which gave a head weighing twenty pounds. Judging from this single head it is an excellent strain; head very solid; leaves light green with yellowish-white veins.

World Beater. Stem short; leaves large and spreading, dark green, edges curled; inner leaves inclosing the head; head flattened, solid. Not particularly promising.

New Dutch Winter. Seeds received rather late, and the plants did not finish their growth; apparently the same as some of the strains of Flat Dutch.

Yellow Dutch Savoy. Stems very short; leaves yellowish-green; matures with second early sorts; heads of medium size, fairly solid.

Savoy—Vaughan. Heads very large but quite loose. Not firm enough to be of any value.

Marvin's Savoy. The best Savoy grown; very solid and quite even in size and shape.

SWEET CORN.

A comparative test of twenty-seven kinds of sweet corn was made, using twenty hills with five kernels of each sort.

Owing to the extremely cool weather of June and July they all averaged from fourteen to twenty days later than last year.

TABLE IX.

Number.	Varieties.	Seedsman.	Per cent of vegetation.	Days to edible maturity.	Days to market maturity.	Number of ears.	Number of stalks bearing two ears.
1	Adams	Landreth	79	80	84	69	0
2	Black Mexican	Ferry	59	89	99	50	9
3	Concord	"	48	94	99	44	5
4	Cory	"	63	78	82	54	10
5	Crosby	"	45	89	94	30	6
6	Egyptian	"	23.6	111	120	25	6
8	Hickox	"	61	89	94	39	2
9	Landreth	Landreth	27	116	126	48	18
10	Leet	Ferry	34	80	84	39	7
11	Mammoth	"	64	111	120	69	22
12	Marblehead	"	34	80	86	29	7
13	Minnesota	"	32	89	94	68	17
14	Northern Pedigree	Thorburn	66	80	84	53	12
15	Old Colony	Ferry	39	101	116	80	25
16	Pee and Kay	"	50	84	89	52	6
17	Perry	"	45	82	89	63	15
18	Red Cob	Henderson	70	111	120	45	5
19	Ruby	Burpee	43	111	120	58	14
20	Southern	Ferry	36	84	89	43	11
21	Stowell	Henderson	41	89	96	53	13
22	Ne Plus Ultra	"	69	111	120	27	7
23	Lackey	Gregory	74	80	84	79	12
24	Kansas King	Barteldes	95	111	126	20	0
25	Jerusalem	"	70				
26	Burbank	J. B. Rice & Co.	80	80	84	70	12
27	Red Evergreen	Childs	48	111	120	47	13

Of the varieties that were grown for the first time, the only early sort is the *Lackey.* This is a selected strain of Marblehead, and is particularly valuable as being less injured by smut than the Marblehead or Cory. This was quite noticeable in the field, and on comparing our notes with the introducer's description, it was found that the principal claims made for it were its freedom from smut and better quality. For these reasons it promises to be very valuable.

Among the late kinds were the following:

Red Evergreen—Childs. A valuable late variety with dark red kernels. Differs from Evergreen only in color.

Red Cob—Henderson. The introducer claimed that this was a sport from Evergreen with red cobs, but as grown by us, the cobs were white, and the corn was in every respect similar to Evergreen.

Kansas King—Barteldes. A very strong-growing starch corn, but it was far from productive. Requires a long season.

Ruby—Burpee. A late sort with dark red stalks and husks. Very productive; ears large, fourteen rowed; excellent quality.

Of the older sorts *Landreth* and *Old Colony* seem to be identical, and are among the best of the intermediate kinds, owing to their productiveness and high quality.

The Cory is still the earliest variety tested, but Lackey follows very closely and is preferable to Marblehead, Northern Pedigree, or Burbank. As a second early, Leet, Perry, or Crosby are as good as any, and Concord, Old Colony, and Mammoth carry out the season.

PEAS.

The test of varieties of pea was carried on in the same manner as last year, two hundred seeds of each sort being sown in parallel rows and the vines supported upon a woven wire trellis. It was proposed to obtain the number and weight of the peas produced by each sort, but some of the pods were mixed in gathering, and we can give only an estimate of the productiveness based on the appearance of the crop.

TABLE X.

Number.	Varieties.	Seedsman.	Days to edible pods.	Days to market maturity.	Length of market maturity.	Av. No. of peas in a pod.	Relative productiveness.
1	Abundance	Ferry	65	72	17	6.4	9.2
2	Admiral	Henderson	62	68	14	6.6	8.8
3	Advancer	Ferry	52	62	16	4.8	8.3
4	Alpha	Ferry	46	49	28	6.	8.2
5	Blue Beauty	Henderson	48	56	14	5.	9.8
6	Chelsea	Henderson	50	54	13	5.6	9.4
7	Clipper	Rawson	46	49	13	6.	9.6
8	Crosby	Crosby	65	75	12	6.	9.2
9	Don	Henderson		62	15	6.8	9.3
10	Dwarf Sugar	Henderson	56	62	20	6.6	9.1
11	Everbearing	Burpee	77	77	10	4.6	7.5
12	Evolution	Burpee	77	84	13	7.4	9.4
13	Fillbasket	Henderson	72	77	17	8.	8.1
14	First	Henderson	46	49	10	6.2	8.3
15	First Best	Ferry	46	49	11	5.8	9.5
16	First Market	Livingston	46	49	13	6.4	9.1
17	Forty-fold	Landreth	70	75	14	6.6	7.5
18	Hancock	Gregory	46	49	13	5.	9.
19	Heroine	Henderson	70	77	13	8.2	7.
20	Kent	Ferry	48	61	26	6.4	9.2
21	Kentish Invicta	Ferry	50	56	20	5.	7.3
22	Landreth Early	Landreth	48	49	16	5.8	8.5
23	Little Gem	Ferry	52	56	21	6.2	7.2
24	Mayor	Henderson	77	84	18	5.8	7.1
25	Market Pride	Burpee	69	72	16	5.	7.8
26	Marrowfat	Gregory	70	73	15	6.	9.4
27	Minimum	Ferry	50	56	14	5.	8.2
28	Nott Excelsior	Gregory	48	53	10	7.6	9.
29	Philadelphia	Gardiner	52	56	21	5.4	8.2
30	Profusion	Burpee	66	72	18	6.	9.5
31	Quality	Burpee	58	72	12	6.6	8.2
32	Quantity	Burpee	62	66	14	6.6	8.5
33	Rural New Yorker	Root	54	57	24	5.4	8.8
34	Strategem	Ferry	71	84	8	6.4	7.1
35	Telephone	Ferry	62	66	22	5.4	6.5

TABLE X—*Continued.*

Number.	Varieties.	Seedsman.	Days to edible pods.	Days to market maturity.	Length of market maturity.	Av. No. of peas in a pod.	Relative productiveness.
36	Tom Thumb	Ferry	50	53	13	6.8	7.5
37	Yorkshire Gem	Henderson	72	77	11	5.8	6.6
38	Yorkshire Hero	Ferry	72	77	12	4.6	7.5
39	Am. Wonder—Bergen	College	46	49	13	6.4	8.5
40	Bergen—Am. Wonder	College	46	49	11	6.2	8.2
41	Bergen	Gregory	48	49	11	5.4	8.1
42	Best Early	Burpee	46	49	10	6.2	8.3
43	Epicure	Henderson	48	50	12	6.	6.
44	Favorite	Gregory	72	77	18	6.2	7.3
45	John Bull	Henderson	84	92	17	7.	8.1
46	Lightning	Hallock	46	49	13	6.4	9.3
47	Market Garden	Henderson	70	77	18	6.8	8.7
48	Marvel	Maule	70	80	15	7.8	9.7
49	McLean	Henderson	72	82	10	8.2	8.7
50	Midsummer	Henderson	70	77	13	5.8	8.3
51	Morning Star	Hallock	46	50	11	5.	8.
52	Premier	Angell	54	56	6	------	2.
53	Sander's Marrow	Henderson	77	77	30	5.	3.
54	Summit	N. B. & G. Co.	47	49	13	5.6	8.
55	Wm. Hurst	Gardiner	------	----	9	------	4.
56	American Wonder	Ferry	49	53	9	6.8	9.
57	Mummy	----------------	92	97	10	5.	6.

From the large number of sorts maturing in about forty-six days, one can make no mistake in selection, as they are at best only distinct strains, bearing distinguishing names given them by the different seedsmen by whom they are sent out. The Clipper, Hancock, Landreth, Lightning, First and Best, and First in Market, extra early sorts, were perhaps the best kinds grown, although the other strains were practically as good.

The Advance, Blue Beauty, Nott Excelsior, Don, Chelsea, and Profusion are good second-early kinds.

Admiral, followed by Marrowfat, Champion, Marvel, and other sorts would complete the season.

Very few of the tall-growing English sorts succeed here. Of the new sorts the following are valuable.

Blue Beauty. A dwarf extra-early pea ready for use within two days after the half dwarf kinds. Growth strong and even; height of vine twenty inches; pods of medium size and well filled; quite productive and very desirable.

Chelsea. About one fourth larger than American Wonder in plant, and fully as early; pods a little longer than Blue Beauty and with a hook at the end. The pods average about one eighth larger than those of other varieties of its class except Nott's Excelsior. One of the best of the dwarfs.

Clipper. In general appearance much like the other half-dwarf, extra-early sorts; fully as early as any of them, and excelling in vigor and productiveness. As good as any, if not the best strain grown.

Don. A second-early sort, ripe ten days after Clipper; vines from three and one half to four feet high; pods long and large, well filled. Quite

productive. As it comes at a time when no other varieties are in their prime, it will be well received.

Kent (extra early). An old variety which is not commonly grown. Vines three feet high, very strong and vigorous, ripens with Landreth Early. Excellent for market.

Heroine. A very vigorous variety with vines three feet in height, ripening with Marrowfat; pods quite long but not very well filled The number of peas, not all perfectly developed, however, averaged over eight to the pod. An English pea which hardly seems adapted to our climate, as the past was a very unfavorable season for all varieties of pea.

Mayor. A late variety growing three feet high, pods somewhat shorter than the last but still quite long, peas quite large, averaging six to a pod. Not promising in productiveness this year, but in other localities and seasons it may do better.

Nott Excelsior. An early dwarf sort growing about fourteen inches high, in general appearance about like Chelsea, although it is taller and has larger and longer pods; hardly as productive as that variety.

Admiral. A medium-size variety coming in just before the late sorts. Pods of medium size, produced in large numbers, well filled. A promising sort.

TRANSPLANTING ONIONS.

In order to test the claims made for this method of growing onions, seeds of seven varieties were sown in a hot-bed April 10, and on the 16th of May they were transplanted to the field, and seeds of the same sorts were on the same day sown in a parallel plat for comparison.

The transplanted onions were placed in rows fifteen inches apart and at intervals of four inches in the rows. The soil was a rich sandy loam and received the same care as was given the adjoining tract containing a field crop of onions.

The result in every case was in favor of the transplanted onions; the results from the three best kinds being as follows:

	Bushels per acre.	
	Transplanted.	Not transplanted.
Prizetaker	548	216
Southport	296	172
Rocca	556	110

The four weeks following the sowing of the seed in the open ground were quite dry, and the plants made a slow start. The transplanted ones received a copious watering when set out and did not suffer. The results were certainly in favor of transplanting but although it will probably pay for home use and for truckers it is doubtful if it would for large crops.

In the South the method would be more desirable.

L. R. TAFT.
H. P. GLADDEN.

AGRICULTURAL COLLEGE, MICH.,
January 1, 1892.

KEROSENE EMULSION AND ITS USES.

Bulletin No. 76, October, 1891.

The Entomologist of the station is very glad to receive specimens of insects, and will always answer inquiries regarding the same. Insects should be sent by mail in close, strong boxes—tin or wood. Pasteboard boxes are not strong enough, and are often crushed. Insects sent in letters are almost always crushed beyond identification unless inclosed in quills or capsules. The postage will not be more than one or two cents. A little cotton with the insect will prevent jarring and breakage. In case larvæ, caterpillars, grubs, etc., are sent, some of their food-plants should take the place of the cotton. This prevents shaking and supplies food. No holes should be made to supply air. Any information regarding the insects sent, will be greatfully received, and may prove very valuable—where found; damage done; and any other facts.—A. J. Cook.

This insecticide is becoming so important in the work of fighting our insect foes, that any new facts concerning its manufacture and use will be eagerly studied by every enterprising fruitgrower and farmer. We have experimented very extensively this season and are glad to bring our results to the attention of all interested in the warfare against insect pests.

Before entering into the general discussion, I wish to correct my former Bulletins, Nos. 58 and 73, in one or two points which further information makes necessary.

In No. 58 I stated what was then true, that so far as I knew, I was the first to use and recommend a practical kerosene and soap mixture. I find that one Henry Bird of Newark, N. J., as early as 1875, two years before my discovery, advises mixing "a *little korosene oil*" with "*strong* soap-suds." He adds " It readily combines and can be applied uniformly with a syringe." This last statement makes it almost certain that he secured an emulsion. He doubtless heated the soap to dissolve it (as I did two years later) and used his syringe to mix, whereupon with the suitable proportions "*little* oil and strong soap suds" an emulsion almost immediately follows. I find the above item in the Gardener's Monthly for 1875, p. 106. In Bulletin No. 73 we say Dr. Riley's emulsion always fails with us. We then used hard water from our artesian well as it was far more convenient. With perfectly soft water it does not fail, which fact was first suggested the past season by Prof. F. J. Niswander of Wyoming University, then an assistant in our laboratory, whose valuable aid we wish to acknowledge.

A good emulsion is one that is easily produced, and one in which the kerosene oil will permanently unite with the emulsifying agent and not separate upon dilution even if allowed to stand for days or weeks. As water will always be the diluent, no formula is desired which will not give success, when hard water is used in making or diluting our emulsion, as often no other than hard water will be at our command. While ease and certainty in forming our emulsion, and permanence of the mixture of the kerosene with the emulsifying agent, are of first importance, after these are positively secured the less the amount of the water used the better; as, in case we desire to carry our emulsion some distance before use, we can delay

dilution and will have less to carry. Though not very important this point is worthy of consideration. It were better if the emulsion upon standing could always be diluted, even though cold, with cold water either soft or hard. With some kinds of hard soap this is quite impossible with all desirable emulsions so far as we have tried them. Yet as all will do so upon heating them, or heating the water used to dilute them, the objection is not serious. Often an emulsion upon standing forms a fibrous or curdy mass, which upon dilution becomes stringy or granular, does not liquefy, and rises to the top.. Immediate dilution upon making the emulsion, or heating, either the emulsion or diluent, at any time subsequent when we wish to dilute it, prevents all such trouble. Thus this is no positive evil, only a matter of inconvenience.

In making an emulsion, violent agitation is positively required. Simply stirring with a spoon or stick is not sufficient. The best method is to use a pump and force the liquid back into itself, through a small nozzle This stirs the liquid very violently and, in two or three minutes, we obtain a thick creamy substance, which is the emulsion. The cheap dollar pumps work admirably and are all that is required. Any pump that will do for spraying may be used. That an emulsion may be easily made, and permanent after dilution with hard water, it is necessary to have an excess of water. Thus a diluted, and often an undiluted emulsion, will separate from the soap solution; but the kerosene oil never separates, it always remains in an emulsion which rises above the soap solution. This is no objection, as by shaking the diluted and warming when necessary, diluting and shaking the undiluted, all will mingle or mix in one uniform liquid and remain mixed for some time before the emulsion again rises to the top. The separation of free oil is a fatal objection; the separation of the emulsion from an excess of soap solution is no objection.

Several formulas for making emulsions have been recommended, which we will give in order of excellence as we find them and the reasons for and against each. We advise all to try each one, as it takes but little time, then the advice and suggestions here given will be appreciated.

NO. 1, SOFT SOAP AND KEROSENE EMULSION.

Dissolve one quart of soft soap in two quarts of boiling water. Remove from fire and, while still boiling hot, add one pint of kerosene oil, and immediately agitate with the pump as described above. In two or three minutes the emulsion will be perfect. This should be diluted by adding an equal amount of water, when it is ready for use. This always emulsifies readily with hard or soft water; always remains permanent, for years even; and is very easily diluted, even in the coldest weather, and without any heating. In this last respect it has no equal, so far as we have experimented. The objections to it are: We can not always procure the soft soap, though many farmers make it, and it is generally to be found in our markets. It occasionally injures the foliage, probably owing to the caustic properties of the soap. We have used this freely for years, and never saw any injury till the past season. In case of any such trouble, we may use only one half the amount of soap—one pint instead of one quart. It works just as well, and we have sometimes recommended this proportion. The soap itself, however, is an excellent insecticide, and we have preferred the stronger solution as given in the formula above, unless it injures foliage which will rarely be the case in a one fifteenth kerosene mixture. Again,

we have a large amount of water. We like this, as it insures a ready and quick emulsion in all cases, and makes dilution very easy. But if any prefer, the amount of water may be one quart instead of two quarts. This works well, and we have sometimes recommended it, but we like the regular formula, everything considered, the best. In case we use one pint of soap, we should add water to the amount of one and one half times the amount of the emulsion in diluting it. In case we use one quart instead of two quarts of water, we should add twice as much water as we take of the emulsion in diluting. In every case, the substance we use should contain one fifteenth part of kerosene oil, and we must always dilute sufficiently to secure this proportion.

NO. 2. HARD SOAP AND KEROSENE EMULSION.

Dissolve one fourth lb. of hard soap, Ivory, Babbitt, Jaxon, or whale-oil, etc., in two quarts of water, add as before, one pint of kerosene oil, and pump the mixture back into itself while hot. This always emulsifies at once, and is permanent with hard as well as soft water. This is diluted with twice its bulk of water before use. The objection to a large amount of water sinks before the fact that this secures a sure and permanent emulsion even though diluted with hard water. This also becomes, with certain soaps, lumpy or stringy when cold so that it can not be readily diluted with cold water unless first heated. Yet this is true with all hard soap emulsions in case of certain soaps. We can however always dilute easily if we do so at once before our emulsion is cold, and we can also do the same either by heating our emulsion or diluent no matter how long we wait.

NO. 3. THE RILEY-HUBBARD EMULSION.

Dissolve one half lb. of hard soap in one gallon of water. Then add two gallons of kerosene oil and agitate at once. While this, like the formula last given, will readily emulsify, even when cold, with some kinds of soap, with others it fails unless quite hot and frequently with both ivory and whale-oil soap we have failed to obtain an emulsion even though we added the oil at once, until we re-heated the whole, oil and all. This we think a serious objection. A farmer tries to make an emulsion and fails. He is discouraged and gives the whole thing up as a fraud. Again if diluted with hard water the oil invariably separates and rises to the top. This we think a fatal objection. Many report absolute success with this formula. They had soft water. Others complain of total failure. They used hard water. If this worked as well with hard water as with soft we should hardly object to recommending it, yet even then we should regret that the larger amount of oil so cools the liquid that failure so often results, especially with some kinds of soap. Before dilution this is nearly all solid or thick, though in some cases, as with whale-oil soap, a portion of the soap solution separates from the emulsion. As we have said, this is no objection; indeed, in winter, this makes dilution and handling the material much easier. Mr. Hubbard, who, as Dr. Riley's assistant, first formed this emulsion, is worthy of great credit, not only as the first to work out by careful experimentation with soap solution and kerosene, the emulsion principle, but also as the first to recognize its importance.

NO. 4. KEROSENE AND MILK EMULSION.

The late Dr. W. S. Barnard, while employed by the Department of

Agriculture, discovered the method of churning kerosene oil with sour milk and forming the kerosene and milk emulsion. This is easily made but can not be kept long and I think is injurious to plants, as it attracts fungi and dust, and unlike soap solution would be befouling rather than cleansing to animals. I used it considerably several years ago, when both Dr. W. J. Beal and myself thought we noticed marked injury to the foliage. I do not believe it will ever rank with the soap emulsions as an insecticide.

PYRETHRO-KEROSENE EMULSIONS.

A year ago, Dr. A. E. Menke, of the Arkansas Experiment Station, announced a new insecticide which Mr. G. C. Davis, Assistant Entomologist of the Michigan Agricultural College and then temporary assistant to Dr. Menke, found a decided improvement upon the simple kerosene emulsion. This is made by using a kerosene extract of pyrethrum instead of pure kerosene oil in either formula No. 1 or No. 2, as already given. The extract is obtained by filtering one gallon of kerosene through two and one half pounds of pyrethrum or insect powder. To filter we place the powder in a funnel lined with coarse paper, and turn on the oil. We can get the filter paper of any druggist, who will show us just how to put it in the funnel. We found this pyrethro-kerosene emulsion more effective to kill insects, and less injurious to foliage than is the simple kerosene emulsion, and a one twelfth emulsion harmed no foliage, while a one fifteenth kerosene emulsion was as strong as we could safely use on many kinds of plants. The objections to this are its cost and the extra trouble in making it. From many experiments, tried this season, we believe this will prove one of our very desirable insecticides. We advise all to try it in all cases where the kerosene emulsion fails.

KEROSENE EMULSION FOR LICE AND TICKS.

In Bulletin No. 73, issued last April, we advised the use of the kerosene emulsion to kill lice on cattle, horses, and hogs, and ticks on sheep. We had then only used it on cattle for cattle lice. We have since used it on horses, hogs, and sheep, and are fully persuaded that it ranks first in effectiveness and cheapness as a specific in all such cases. The many letters that we have received the past summer relating to the use of the emulsion, the more timely date and the exceeding importance of the matter, make us repeat with emphasis the advice we then gave. Lice and ticks are very common in nearly if not all the flocks and herds of the state. They claim no mean per cent. of the strength and vitality of our animals. Well-fed animals are not always slick and fine. The cause is not infrequently found in the tormenting, blood-sucking lice. Tobacco decoction, crude petroleum, and the various commercial dips, are less efficient, not so wholesome, and more costly. Kerosene emulsion, not only kills all the lice, but also the nits or eggs, and if the stable be well sprinkled with the emulsion at the same time that the animals are treated, the application will need to be repeated only at rare intervals. Again, brushing the animals thoroughly with the soap wash seems to clense the skin and make the coat more bright and glossy. Without any question the kerosene emulsion barrel should find a place in every stockman's barn.

The soft soap emulsion is best for this. The more liquid nature makes

it easy of manipulation in cold weather, and the large quantity of soap is very cleansing and wholesome. Formula No. 2, however, will work well, especially as we shall wish to warm it at the time of each application. To apply this, we use a common brush in case of cattle, horses, and hogs; and in case of sheep, dip the animals right into the warm, diluted emulsion. The cost of material for an average cow is about three cents, and the time required for treatment, less than five minutes. For lambs and sheep, after shearing, the cost of material is not to exceed two cents, and the time required for the immersion need not be one minute to each animal. The person dipping the sheep stands in the tank or vessel that holds the diluted emulsion. We have tried this very thoroughly on cattle, hogs, and sheep. The scrubbing of the cattle and hogs with the soft soap solution, by use of a good brush, to quote from our herdsman, "kills the nits, makes the coat glossy, and leaves the skin mellow and clean." No farmer in Michigan can afford to neglect this excellent treatment. So cheap, so easy, it leaves no longer any excuse for vermin, infested barns and stock.

KEROSENE EMULSION FOR THE ROSE CHAFER.

Now that we know how to combat the codlin moth, *Carpocapsa pomonella*, by use of the arsenites, there is no insect enemy so much to be dreaded by the fruitgrowers as the rose chafer, also called rose beetle or rose bug—*Macrodactylus subspinosus* Fab. There are three reasons for this: Few destructive insects come in such overwhelming numbers, and so come prepared to fairly devastate a region in a very brief period; few are so promiscuous in their feeding habits, blighting nearly all our fruit trees, and the grape; and very few seem so able to defy man's efforts to stay their ravages. Heretofore no satisfactory remedy for this devastating evil has been known. Jarring and trapping, as we fight the curculio, has been recommended, but has not given satisfaction in actual practice. Poisoning with London purple or Paris green has utterly failed to stay the ravages of this insect. Fruit men often say, "The rose chafer seems to grow fat on the arsenites." Whether this is due to some strange power to resist this usually fatal poison, or to the fact of the unlimited numbers of the insects, so that, as soon as one battalion is slain, another is in readiness to occupy its place, it is difficult to say. It is quite possible that both reasons help to explain the enigma.

This past season we have tried in a limited way both the kerosene emulsion and the pyrethro-kerosene emulsion, with very promising results. Of course, a limited trial for one season is not conclusive, but where the damage is so discouraging and terrible, any remedy promising relief should be at once given to the public, that its virtue may be tested on a larger scale in actual practice; especially if as in this case it is so easily and cheaply done.

Mr. Albert Jackson of Lowell, Mich., has in former years suffered great losses from this rose beetle. This year one of us, Mr. G. C. Davis, visited Mr. Jackson's place. The beetles did not come in such enormous numbers as usual and had not yet attacked the peach foliage or fruit, but were thick on a hedge row of wild roses. As the weather was quite cool the beetles were not very active and it was easy to treat them. They were sprayed with a one fifteenth hard soap emulsion (Formula No. 2). Some of the beetles were immediately caught and inclosed in a well ventilated box. Nearly all were dead within two hours and all the next day. Others not

treated, put in a similar box, were alive and lively after the lapse of two weeks. Mr. Jackson wrote us some weeks afterward that this seemed to kill all the beetles and did not the least harm to the foliage of the plants. Mr. Davis also treated others of these chafers with pyrethro-kerosene emulsion with precisely similar results, except that the rose chafers died more quickly than when treated with the kerosene emulsion only. Sludgite was also tried but with no success.

Mr. Jackson writes us that the experiment was too limited to be fully satisfactory. The kerosene emulsion and the pyrethro-kerosene emulsion seemed to kill the chafers, while the sludgite did no good. The foliage was not injured. He adds that the rose foliage may be more able to resist injury than that of the peach. We also tried the effect of both the kerosene emulsion and the pyrethro-kerosene emulsion on these chafers in the laboratory. We had but few to experiment with as the insect is not, and has never been, abundant at the college. We sprayed the beetles and inclosed them at once in a well ventilated box. They all died within a few hours, and those sprayed with the pyrethro-kerosene emulsion all died in even a less time. As Mr. Jackson says, these experiments are too limited in both numbers and extent to be satisfactory, but we have other evidence which is more extensive and is right to the point. Mr. C. E. Allgeo wrote me in early July, in substance as follows: I wish to thank you most heartily for Bulletin No. 73. I have suffered in previous years terribly from the rose bug or rose chafer. Now I know how to treat him every time. I am no longer in dread of this terrible foe of the peach-grower. I made the kerosene emulsion just as you describe in Bulletin 73, using soft soap. It worked just as you describe and mixed perfectly upon dilution. I sprayed the trees as soon as the insects made their attack and killed all of them that the emulsion struck. I have no longer any fear of this pest. Your emulsion signs his death warrant. Let me add that the emulsion diluted as you direct (one fifteenth kerosene), did not the least harm to the foliage of the trees. We wrote to Mr. Allgeo suggesting that insects often disappear very suddenly and queried if it might not be that they would have gone any way, that possibly it was not the emulsion that killed them. He replied as follows: "You seem to be afraid that I may be mistaken in some of my conclusions regarding the kerosene emulsion and rose chafer. Let me say that I have too good reason to be acquainted with their habits; I know that they often come and leave very suddenly. But the experiments were conducted with the greatest care, and I wish to reiterate, that your emulsion will kill any rose bug in one half minute after it touches him. *It does not drive them away but kills by contact.* If used diluted as you direct, it will do no harm to either the fruit or foliage of the peach. I observed this point very closely, and neither the leaves nor young peaches were injured in the slightest degree."

These experiments by a very cautious, intelligent peach-grower are exceedingly interesting. They agree with ours, tried both in the field and laboratory, except that the beetles, with us, did not die so quickly, though they did fall at once and appear dead, though life did not cease in many cases for some time. Mr. Allgeo's experiments also agree with ours of previous years, in that the soft soap emulsion, one fifteenth kerosene, did no injury to the foliage or fruit. Prof. J. B. Smith of the New Jersey experiment station reports very careful and extended experiments with kerosene emulsion and pyrethro-kerosene emulsion, and states that he utterly failed of success. In the face of this report, it seems to us that

our results, sustained by the more extended trial by Mr. Allgeo, warrant this early publication of the success—or shall we say apparent success—of our efforts here in Michigan.

The matter is of such great importance and the expense of a trial so light that we think it should be thoroughly tried by all interested, another year. Let us suggest that formula No. 1 be tried when convenient, but that a preliminary trial be made to see if the foliage is injured. I feel sure that it will rarely be at all injured. If injured it will show it in a few hours and the quantity of soap may be reduced one half. Otherwise the formula should be used as it stands.

HOT WATER AND THE ROSE CHAFER.

While discussing remedies for the injury done by the rose bug, we must report our trial of Mr. E. S. Carman's hot water treatment. Early in the season Mr. Carman sent us an advance printed slip from his paper, the Rural New Yorker, stating that he had found that hot water, considerably below the temperature limit of injury to the foliage, would kill the rose chafer. We were requested to try this remedy and report. We made as full a trial as the limited number of insects at our command would permit. We found that water at the temperature of 130° F. was fatal to the chafers in every case, while in no case was foliage injured by being sprayed with water below 150° F. Leaves dipped into water at 150° F. were badly injured. We sprayed on a cool day and found it difficult to keep the water at the proper temperature; we think we can safely say that this remedy is totally ineffective except it be used on warm days. We found on a hot day at noon time, water which in the barrel was 150° F. was 145° four feet from the end of a six foot hose used on a force pump. Our experiments proved that we could not use a spray nozzle even on a hot day and keep the proper temperature above 130° F. in actual practice. By using a common nozzle, we can apply the hot water sufficiently hot to kill. The hose after once heated cools the water but little, and water at 150° F. in the tank or barrel, will still be above 130° F. several feet from the end of the hose. From our limited experiments on the beetles and quite extended experiments with hot water, we are led to hope that on hot days, by using a common, not a spray nozzle, we may be able to fight the rose chafer successfully with hot water. We would take two barrels of water in our wagon, one boiling hot, the other at 150° F. By dipping from the former into the latter we could easily keep it at the desired temperature. While we look with hope upon this treatment, we look with more favor on the kerosene emulsion, which to make assurance doubly sure may also be hot, when we would combine both agents in the work of destruction. We also tried hot water on the squash bug, *Anasa tristis*, but with no success. It requires 165° F. to kill them, while 150° F. kills the plants.

FIGHTING THE HOLLYHOCK BUG.

Last year and this our hollyhocks were attacked by a green bug, *Orthotylus* (*Psallus*) *delicatus* Uhl. We find this attacks the hollyhocks worse than any other plant, though we find it also on the common mallow. We therefore call it the hollyhock bug.

As we do not know of any description of this bug in any bulletins, reports, or accessible treatises on economic insects, we give the following:

DESCRIPTION OF IMAGO (FIG. 1.)

Color bright green. Head yellowish, triangular, broad. Eyes globular, yellowish, with a dark center. Antennæ nearly as long as the body, four-jointed, hairy, yellowish at base becoming dusky toward the last joint, which is nearly black. Hairs on first two joints dark, on last two light. First joint heavy, short, and black at base; second four times as long as first, third two thirds as long as second, fourth one half as long as third; all but the first joint slender. Rostrum (*Fig. 1, a*) or beak yellowish; four joints; reaches to middle legs. First joint robust, the remaining three slender, the last one longest and black except at base. Pronotum—upper part just back of head—trapezoidal, widest behind, yellowish varying to green. The posterior two thirds is often distinctly green. A depressed transverse line cuts off from the front about one third, which part is also divided by a longitudinal median line, into equal portions each of which has a central rounded elevation. The pronotum is margined. The scutellum varies in color and is green or yellowish. The legs like the whole underside are greenish yellow; the feet or tarsi black at base and tip and light in the middle. The claws are black. The hemelytra or wing covers are green. The clavus (*Fig. 1, d*) is dark green; the corium (*Fig. 1, e*) lighter; the embolium (*Fig. 1, f*) is narrow and still lighter, though the depressed line separating it from the corium is very deep green. The cuneus (*Fig. 1, g*) is indistinctly differentiated. The whole upper portion of head, thorax, and base of wing-covers is specked with short, stiff, black hairs. The membrane (*Fig. 1, h*) is smoky, with a wide greenish basal margin which is dusky centrally and abreviated externally. The narrow internal margin of the membrane is black. The insect is a little more than four mm. (16-100 in.) long and about one third as broad.

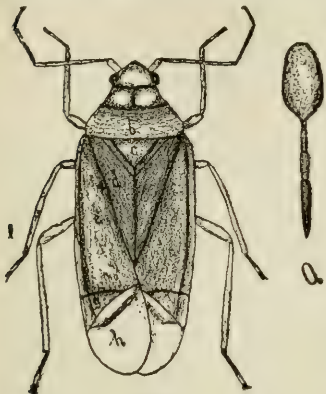

FIG. 1.

These bugs are a very serious enemy to the hollyhock. They swarm upon these plants early in the season, and often so suck out the juices or sap that the plants become blighted and not infrequently wither and die. This year we treated these insects with the kerosene hard soap emulsion (No. 2), the pyrethro-kerosene emulsion, and with sludgite. The plants treated with the two emulsions were entirely freed of the pests while the sludgite apparently did no good.

THE YELLOW-LINED CURRANT BUG.

This insect (Fig. 2) is not uncommon in Michigan, and is easily found every summer, but the past season they have been uncommonly numerous and destructive. We have had as many as three letters a day complaining

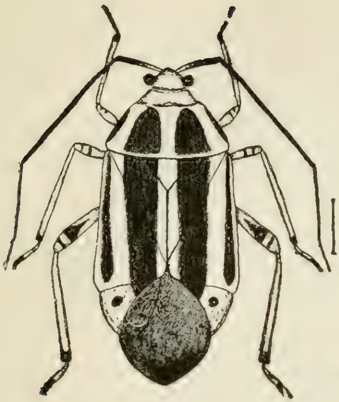

FIG. 2.

of this insect, and inquiring for means to lessen its numbers and destruction. While it sucks the juices from many plants, it works most seriously on the currant, and so we propose the name, *Yellow-Lined Currant Bug.* The scientific name is *Pœcilocapsus lineatus* Fab. The following brief description will enable any one to easily identify this annoying pest. The bug is bright yellow, lined with black, though the heavy black lines cause it to appear as if lined with yellow. The head, anterior margin of the thorax, base of antennæ, rostrum or beak, and entire under parts, orange. Eyes, antennæ, clypeus, labrum, point of beak, and shading on under side of abdomen, black. Eyes subglobular, prominent. Antennæ slender and nearly as long as the body. First joint almost half as long as the second, third joint a little longer than the first, and fourth about half as long as the third. Rostrum or beak slender, reaching anterior legs. Pronotum yellow, margined anteriorly with a depressed orange band. The posterior yellow portion bears four black lines. The central lines are broad, the lateral narrow and marginal. None of these lines reach anteriorly beyond the yellow area. The scutellum has a broad central area of yellow, margined on each side with a black triangle. The legs are yellow, with black specks on the femora and tibiæ. The tips of the tarsi are black. The thickened portions of the hemelytra, or wing covers, are yellow, each bearing two conspicuous black lines. The inner lines are broad, the outer ones narrow. The outer or narrow lines are broken near the end, so that a black dot appears on each cuneus. A narrow margin, both inner and outer, on each wing cover, is yellow; also a central line which is about as wide as the narrow black line just outside of it. The membrane is nearly black, with an oval anterior area on each wing cover, which is bounded by a heavy black line. This area does not reach the outer margin of the wing. The length of the insect is seven mm. (28-100 in.) long and the breadth is 3 mm. (12-100 in.).

We sprayed these striped currant bugs on the bushes and in the laboratory with both kerosene emulsion Nos. 1 and 2, and with pyrethro-kerosene emulsion. There were almost too few bugs on the currant bushes to make the experiments satisfactory, but in the field and in the laboratory both applications killed the insects, and the bushes in the garden were freed of the blighting bugs. We also tried sludgite on these striped currant bugs and killed them, but to do this we immersed the bugs in the liquid. Our experiments with sludgite are not encouraging.

THE SQUASH BUG.

The old-time enemy of the squash, *Anasa tristis*, De G., is too well known to need description. The brown egg clusters, the dull yellowish larvæ and pupæ, the black imago, are all familiar to every gardener. Their destructive work on squashes and other cucurbitaceous plants is too obvious to escape attention. The mature bugs hibernate in winter and often appear in devastating numbers in early spring when the plants are small and illy able to resist the attack. Soon the egg clusters are seen on

the leaves and not long after the young larvæ appear. These will be found of all sizes through the summer and into the autumn. To fight these insects successfully is a most difficult undertaking. Trapping them under boards at night, and gathering and killing them very early the next morning, before they have dispersed, is a laborious proceeding. Hand picking, and sweeping or brushing them into a vessel containing kerosene oil is still more hard and irksome. We had hopes that we could use the kerosene emulsion or at least the pyrethro-kerosene emulsion successfully in destroying these bugs, but on the old bugs we fail entirely. We have not been able to kill them except we used an emulsion so strong that we also killed the plants. We can kill the eggs and nymphs with either emulsion but not the mature bugs. Pyrethrum either as powder or in the liquid form has no effect on the imago, and so we were not greatly surprised that the pyrethro-kerosene emulsion was not superior to the simple kerosene emulsion. As we have no good remedy for this mature squash bug it is very desirable that one be discovered.

KEROSENE EMULSION FOR PLANT LICE.

As yet we have never used kerosene emulsion in vain to kill aphides or plant lice. We believe a good one fifteenth kerosene emulsion thrown on with force, by a good force pump, so as to touch every louse, will always give satisfaction. Hundreds to whom we have recommended this specific for these insects, have reported absolute success, while occasionally a person has complained of failure. In the last case we believe that the emulsion was faulty, or more probably its use was delayed till the leaves had so curled up as to protect the lice, or perhaps the liquid was thrown on so mildly that it failed to strike many of the lice, and so of course would not kill them. It must be remembered that this kills by contact. We wish to urge again the wisdom of an early treatment of plant lice, just before the eggs hatch or just as the young lice come from the eggs. Then the buds are just opening, the leaves are still in the bud, and it is easier and much more economical to spray thoroughly than it is to wait till the foliage is fully out. More than this, each day that we wait takes just so much vigor from the tree, and this in the early spring, when the plant or tree needs all its sap for its growth and development. The plant lice pass the winter as eggs. In the spring the little black eggs, which are usually thick about the buds, hatch just as the buds begin to swell or open. All these spring lice are females and ovo-viviparous, that is, the lice are brought forth alive, so we see no eggs except in the fall, winter, and early spring. All the females except the autumn ones produce without males, hence the increase is very rapid. It is wise, then, for every gardener and fruitgrower to note what plants suffer from aphides and then in winter note if the eggs are abundant or else in early spring, just as the buds begin to open, examine to see if the young lice are thick on the buds. In case they are, the kerosene emulsion, one fifteenth kerosene, should at once be dashed upon the trees, when the lice will be quickly exterminated. Another advantage of this early treatment is the less likelihood of injury to the foliage. We applied a one fifteenth soft soap emulsion (No. 1) to plums the first of June. It killed all the aphides but injured the foliage. We concluded that it was a case of the "last straw," as the foliage had already been much injured by the lice. From later experiments we think it may have been due to the quality of the soft soap, as already explained. We have a

few reports that the kerosene emulsion is powerless to kill lettuce lice in forcing houses in winter. If, after observing the suggestions given above, this ill success still occurs, we would urge that the pyrethro-kerosene emulsion be used. We are quite sure it will prove fatal. Indeed, pyrethrum extract or pyrethrum in water, is alone generally fatal to these lice. If the pyrethro-kerosene emulsion were applied hot, and it would be no more difficult, say at a temperature of 130° F., we would have yet another element of destruction. So I am sure our lettuce, growers need not despair of success because of the lettuce plant louse.

KEROSENE EMULSION AND THE PEAR AND CHERRY SLUG.

We find that the kerosene emulsion is quick death to the cherry slug, *Eriocampa* (Selandria) *cerasi*. In case a tree is suffering both from slugs and plant lice, then surely we should use kerosene emulsion, and kill two birds with one stone.

KEROSENE EMULSION AND THE PEA WEEVIL.

As is well known, the pea weevil, *Bruchus pisi Linn.*, is a very common and troublesome insect in all the northern states. The yellow eggs, often as many as eighteen, are glued to the outside of the pod. On June 16, we sprayed our pea vines with kerosene emulsion, marking several pods on which were eggs, and noting the number and position of the eggs; June 25, an examination was made, of the four marked pods, and not a single larva was found in the peas. An extended examination of the pods sprayed did result in finding some larvæ but by no means as many as were found in pods or vines untreated. We think there is very little doubt that the use of kerosene emulsion would reduce the injury from the pea and bean weevils very materially. Whether the advantage would warrant the outlay for any but those growing seed, I can not say. We also tried London purple on the peas in the same way, but with no seeming advantage.

STRENGTH OF KEROSENE EMULSION.

A large number of experiments were made June 30, and repeated two weeks later, to determine the maximum strength of kerosene emulsion, both soft soap (No. 1) and hard soap (No. 2) and of pyrethro-kerosene emulsion, which it would be safe to use on our cultivated plants. The experiments were tried on cucumbers, squashes, peas, cabbage, raspberry, rose, currant, grape, quince, peach, plum, apple, and cherry. As fifteen experiments were tried on each plant, there were nearly four hundred in all. We used one part of kerosene to 10, to 12½, to 15, to 20, and to 25, of the soap solution. The plants were examined very soon after treatment, and again some days later. Our conclusion is that a one fifteenth hard-soap emulsion (No. 2) is safe on all plants.

We can not say that of the soft soap emulsion (No. 1), though it has been true in our experiments of previous years. In a few cases the plants were injured. This was doubtless due to the quality of soap as already explained. We like the soft soap emulsion and like the full quantity of soap, but if upon trial plants are injured, the amount of soap may be reduced one half. We found we could safely use the pyrethro-kerosene emulsion on all plants with which we experimented at the strength of one

of kerosene to twelve and one half of the soap solution. Thus with our present light, we recommend a one fifteenth kerosene emulsion and, if necessary, a little stronger pyrethro-kerosene emulsion, one part of kerosene to twelve of the soap solution. This, of course, implies that the emulsion shall be perfect. *There must be no free oil.*

THE OAK CATERPILLAR.

This caterpillar, *Edema albifrons A. & S.*, we find in not very conspicuous numbers each year. This season it has come in armies in nearly all portions of central and southern Michigan, so that it has been repeatedly referred to as the "Army Worm." This is a Bombycid or silk moth, while the old army worm, *Leucania unipuncta, Haw.*, is a Noctuid moth. The caterpillars and moths are wide apart in relationship and appearance. The true army worm feeds on the cereals, this on the oak. Environment is often kind to the army worm, so that it frequently comes upon us in armies while never before have we known of this oak caterpillar appearing in such multitudes. This insect may well be called the White Oak Caterpillar, though it feeds to a less degree on other oaks and on maple, beech, and elm, and very rarely on hawthorn and apple. Many of our white oak forests in central Michigan have been stripped of leaves the present season, so that they are as bare as in late spring after the old leaves have fallen.

The moth (Fig. 4) comes in June, and lays her eggs on the leaves of the trees; the larvæ feed in late August and September. This year they were so common that bare ground underneath the trees was often fairly paved with the small shot-like fecal pellets. As the larvæ become fully grown, (about Sept. 15 in this locality,) the caterpillars eat off the stems so that the ground beneath the trees becomes carpeted with the fallen leaves. Many caterpillars fall to the ground with the leaves, and then seek some suitable place in which to spin their cocoons and pupate.

Description of Larvæ. The caterpillar (Fig. 3) is very easily known by its very prominent reddish brown head, and a conspicuous red, often yellow, hump on the next to the last, or eleventh, segment. It is striped longitudinally with yellow, black, and white lines. The four yellow lines, which are often tinged with orange, are widest. These are lateral, and subdorsal, and so arranged as to divide the upper half of the caterpillar into three nearly equal stripes, which are marked with narrow alternating lines of white and black. The dorsal stripes have five black lines and four white ones. The black ones are widest and somewhat broken. The stripes between the yellow lines on each side have four white and three black lines, and here the white lines are widest, especially the two inner ones. The black lines are somewhat broken, and the white ones dotted with black. The spiracles are in the lateral yellow bands. The legs, under surface, all below the lateral yellow bands, segment behind the red hump, and the anal plate are yellowish white; and all but the legs and anal plate are lined or dotted with black. The mature larva is four cm. (1.6 inches) in length.

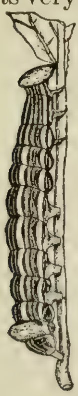

FIG. 3.

DESCRIPTION OF THE MOTH.

The larva pupates between the leaves, or in some crevice, in very slight cocoons. The pupa is finely punctured. The moth (fig. 4.) is gray with

FIG. 4.

a white head, a white V shaped spot on the front of the thorax and a conspicuous white line on the outer half of the front margin of the anteriors wings. This has a sinus on the hind margin. Back of this is an irregular brownish area which is broadest and darkest at the outer end. Two very dark or brownish lines ruin parallel with the outer margin of the wings. The posterior wings are dusky, while the throax is dark gray and the abdomen light gray. The moth expands three and one half cm. (1.4 inches.)

As before stated this insect is usually quite rare, at least not so common as to attract general attention. Owing doubtless to very favorable circumstances, which enabled the insect to reproduce rapidly, we this season were visited by the hoard of caterpillars which have awakened such general alarm; very likely the two very mild winters of '89-'90, and '90-'91, were the favoring conditions. It is quite possible that in average winters the pupæ are destroyed, while in the past two winters, nearly all have survived. Thus myriads of eggs were laid and a multitude of caterpillars were the result. We need not expect, then, a long continuance of this oak caterpillar raid. Possibly, though not probably, they may come in equal abundance next year. That they will continue so numerous for three or even two years is not at all likely. Again, any insect that defoliates the trees so late in the season as September, does comparatively little damage. The insect in this case anticipates frost or maturity but very slightly, and the leaves have really done their work for the season. Thus I am sure that we may suffer no anxiety because of these insects. It is more than likely that we shall never see a like outbreak again.

THE WHITE PINE SAW FLY.

For many years this saw-fly (Fig 6), *Lophyrus abbotii Leach*, has been no insignificant pest on the ornamental pines in the parks and door yards of Michigan. We have received it from nearly every county of the state, and have always recommended spraying the tree with the arsenites, London purple or Paris green, which has in every case quickly destroyed the destroyers.

The *Larva* (Fig. 5) is very light yellow or straw color and has a black head and four longitudal rows of black spots, which are nearly square in the side rows and elongated in the upper rows. The larvæ of the saw-flies are called slugs, for often, as noted in the very common pear and cherry slug, they secrete a slime which always covers their bodies. These slugs do not secrete the slime. Slug, unlike all other larvæ, have eighteen, twenty, or twenty-two legs—the six jointed legs just back of the head, and twelve, fourteen, or sixteen, non-jointed pro-legs, as the abdominal legs are called. This white pine slug has the full number, twenty-two. Many caterpillers have sixteen legs, which is the maximum number in all other larvæ except the slugs. The length of the full grown slug is 22 mm. (.88 inches). The larvæ feed on the pine leaves from July to November, though the insect is single-brooded. When full grown it passes to the earth and forms a thick, oval, watertight, light brown

Fig. 5.

cocoon in some hiding place or between the leaves. The pupa is not especially peculiar except that it has a very large broad thorax and abdomen.

The Imago. The female white pine saw-fly (Fig. 6) comes in June to lay her eggs. She is brown, though often the margin of the thorax and the sides of the abdomen are more or less marked with black. The eyes and ocelli are dark, and the antennæ are black and pectinate. The length of the female is eight mm. (.32 inches,) and about one half as broad. The male is black, except the legs, which are a light yellow, and the tip and under side of the abdomen, which are light brown. It is smaller than the female, being only six mm. (.24 inch) long. The antennæ of the male (Fig. 7) are very broadly pectinate; there are seventeen of the pectinations.

FIG. 6.

FIG. 7.
Antenna of male greatly magnified.

WHITE PINE SAW-FLY PARASITE.

FIG. 8.

This insect is greatly held in check by a beautiful chalcid fly, (Fig. 8,) *Perilampus hyalinus, Say.* We append the original description: Green; wings hyaline; inhabits Pennsylvania; body green, punctured; scutel much elongated, slightly emarginated; wings hyaline, immaculate; abdomen very short, wide, triangular, very convex above and beneath, violaceous; tarsi yellowish; anterior tibiæ honey yellow; length less than one fifth of an inch. Differs from the *P. triangularis* in being destitute of the dusky wing-tips, and in having punctures instead of striæ.

Those that we have reared agree very closely with Say's description. We would only add antennæ, eyes and claws black; veins of wings brown; knees and distal half, more or less, of middle and posterior tibiæ, honey yellow. We have reared these in the laboratory in April, and also in June and July. This is one of our largest and most beautiful chalcid flies.

While this article has been written wholly by Prof. Cook, so much of the work has been done by Mr. G. C. Davis that the plural pronoun has been used when possible. So much and so valuable has been Mr. Davis' part in the work that he very justly appears as joint author. The drawings, except figures 5, 6 and 7, were made by Mr. G. C. Davis, No. 5 by Mr. F. J. Niswander, and Nos. 6 and 7 by Mr. C. F. Baker.

A. J. COOK,
G. C. DAVIS.

AGRICULTURAL COLLEGE, MICH.
June 30, 1891.

KEROSENE EMULSION. NEW OR RARE INSECTS.

Bulletin No. 73, Michigan Experiment Station.

Among the several excellent insecticides few, if any, surpass in value the Kerosene Emulsion. Even the arsenites hardly equal this, as they can only be used effectively against mandibulate insects, while this, as it kills by contact, is not thus limited in its use. It kills sucking insects as well as those which bite and eat the leaves, twigs, etc. I gave last year (see Bulletin 58, or Report of Michigan Board of Agriculture, 1890, p. 220) my formula for preparing this emulsion, as I have used it for years—first in 1877. Last autumn Dr. C. V. RILEY honored me with a visit; he told me that my formula would not make an emulsion, that it only produced an unstable mechanical mixture. But I said it does produce a stable mixture with me, capable of easy and perfect dilution. I said I have some now in our museum which has stood for years. He said, let us look at it. I eagerly produced the bottle. He said, that is no emulsion, that has separated, and is only a mechanical mixture, and was used years before you recommended it, by Mr. TAYLOR and others. At the very interesting and profitable meeting of Entomologists at Champaign, Dr. RILEY recited this occurrence, when Prof. C. P. GILLETTE remarked that he had found the Hubbard-Riley formula much better than the one I had used and recommended. The statement by Prof. GILLETTE seemed to meet general approval. This startled me, as well it might, for I had recommended the Kerosene Emulsion made according to my formula to thousands both through the press and at farmers' institutes. If I had been recommending an inferior article, it was a serious matter. Yet I had this comfort, I had received testimony from a great number and with no complaint. All pronounced it entirely satisfactory. As Prof. L. R. TAFT said to me, when I asked him if he had ever compared the two: "I have never used the Riley emulsion, as I find yours entirely satisfactory. I want nothing better." Thus I was startled, I say, to receive such an opinion from one so exceedingly able as Dr. RILEY, and from so careful and conscientious an investigator as Prof. GILLETTE. I remarked at Champaign that my formula had given me and others entire satisfaction. If the Hubbard-Riley formula were better I should be glad to know it and recommend it.

My formula recommended for years is this: Dissolve in two quarts of water one quart of soft soap or one fourth pound of hard soap, by heating to the boiling point, then add one pint of kerosene oil, and stir violently for from three to five minutes. This is best done by pumping the liquid into itself through a small nozzle, so that it shall be thoroughly agitated. This *mixes the oil permanently* so that it *will never separate*, and can be diluted easily, at pleasure, by simply shaking or slightly stirring after adding the water to dilute it. I have often stated that it was not necessary to use so much soft soap, but was better, as it insured a perfect emulsion even upon dilution, and the soap itself is an isecticide, and valuable, aside from its emulsifying power. I also have stated that in using soft soap a quart of water would do. I prefer, however, the two quarts, as the emulsion is more sure, and the thinner material permits more ready and

more speedy dilution, especially in cold weather. I have always placed soft soap first, as most farmers have it; and convenience is very important in such matters. A farmer will make and use an article when all the ingredients are at hand, whereas he would not do so had he to go and purchase them for this express purpose.

The agitation should be violent, but need not be long. We have formed a perfect emulsion in one minute even with cold water.

The Hubbard-Riley formula is as follows: One half ℔. of soap, dissolved in one gallon of boiling water, when two gallons of kerosene are added and immediately stirred as before. It will be seen that I use four times as much water as kerosene, while Dr. RILEY recommends twice as much kerosene as water. I also use more soap.

THE TWO EMULSIONS CONTRASTED.

My recipe never fails with us to produce a perfect emulsion. *It will even emulsify with cold water*, if the soap is thoroughly dissolved. I have made perfect emulsions repeatedly with cold water; and have repeated it several times this winter. I prefer a hot solution as the soap is more quickly dissolved.

Dr. RILEY'S formula often fails; I think it has failed with us in at least forty per cent. of our trials to emulsify at all. It must be very hot. Prof. GILLETTE says that he often heats the oil, which I should hardly wish to recommend, and any hitch in the stirring after adding the oil is fatal to success. Prof. GILLETTE adds, in a private letter, that he has had failures with this, and urges three cautions: 1st, good soap, like Ivory. 2d, a boiling temperature upon adding the oil, which must not be too cold; and 3d, everything must be clean. With my formula he would not have to urge any of the above.

While the kerosene is thoroughly emulsified in my preparation, the emulsion, owing to the excess of soap solution, often separates from the remaining liquid upon standing, especially if made of soft soap, rising above the soap solution. This is also true of the dilution; but there is no free oil; this is probably what deceived Dr. RILEY and Prof. GILLETTE. They saw this separation, and thought the liquid was not emulsified. Had they tested the diluted emulsion by putting a small piece of paper on top, and then touching the latter upon removal, with a lighted match, they would have quickly found that it was a perfect emulsion. The readiness with which it mixes, upon slight shaking, even years after preparation, is further proof. I have some in our museum made years ago, that is a perfect emulsion to-day. It is that pronounced against by Dr. RILEY. One who has had much experience will be at no loss to distinguish a perfect emulsion as soon as he adds water to dilute it. If there is free oil it will not mix; if not, it mixes very readily and with very slight agitation.

Dr. RILEY'S emulsion thickens completely, looking like thick cream. This makes it hard to handle, especially in winter, as it must be dipped and can not be turned from a vessel; but, more, the viscid mass hides the imperfection of the emulsion so that it does not appear till dilution takes place. The diluted emulsion also is more uniform upon standing, except that in all our experiments free kerosene rises to the top, which is less in case soft water is used.

Again, my preparation is thoroughly emulsified so that upon any dilution, even with hard water, no free oil rises to the top. Thus it is easily

mixed at all times, and may be kept in stock in a dilute or concentrated form for any period. Here again the match test shows that there is no free oil at the top. We have tried a very large number of cases, in all temperatures the past winter, and have not had a single failure. Dr. RILEY'S formula always fails in our hands, no matter how careful we are, to make a perfect emulsion. We now have a large number of bottles of diluted emulsion, of both kinds, made at different times, and every one of the Riley diluted emulsions can be distinguished at once by the free oil. In every case, upon dilution, the Riley emulsion shows this free oil, not a lighter emulsified liquid, at the top. The eye would detect it; its inflammable character proves the eye right. Lay a paper on it, and as soon as the paper is wet take it off and touch a lighted match to it, and it flames up like a kerosene torch. I wondered if our kerosene oil—our Michigan law requires an exceptionally high test—might not be the cause of this, and so I sent to Ohio, Indiana, Illinois, and even Ames, Iowa, where Prof. GILLETTE conducted his experiments, for the grade of oil used in those states. These were carefully tried and all acted precisely alike. Not one gave us a perfect emulsion with the Riley formula, as shown by the dilution, when free oil rises at once to the top, while every one did give a perfect emulsion with mine. Prof. GILLETTE writes in a private letter: "I do not believe it is practicable to make emulsions to be kept before diluting I think they should always be made as wanted and diluted as soon as made." We do not find this true at all of our emulsion; we find it just as good, just as satisfactory, and very convenient to keep it in stock and dilute as we wish to use it. We have found this very convenient not only in summer, but also in winter, when we keep it in the barn ready to use for lice on the stock. But we do find it true of the Riley emulsion, and even then imperfect emulsion makes the diluted liquid unsatisfactory. This fact makes my formula, as we think, very decidedly superior to the Hubbard-Riley. We should consider it a decided calamity had we to give up my emulsion and use the other. The general farmer is not used to experimentation, and we must make all such work as simple and easy as possible, or he will refuse to use our remedies. It is barely possible that the hot climate of Florida, where Mr. HUBBARD conducted his experiments, might make a difference, but as we have worked in warm rooms I do not think this can be true.

The superiority, then, of the emulsion which I advise, rests in ease and certainty of emulsion, ease of forming a dilution at any time which may be kept indefinitely, and, most important, the fact of perfect emulsion. I hope all station entomologists and horticulturists will thoroughly try both these formulæ that our farmers and fruitgrowers may be advised most wisely the country over. This is the more desirable, as there is a widely increasing place for the use of this very valuable insecticide.

Prof. L. R. TAFT has made the above experiments independently, and states to me that he agrees with everything I have said in the above discussion.

KEROSENE EMULSION FOR PLANT LICE.

I have never seen the small black plant lice eggs so abundant as at the present time, April 1, 1891. I have never received so many inquiries regarding them, nor received so many specimens from curious or anxious farmers. Just about as the buds of the fruit trees, etc., commence to open these eggs will hatch; and unless some natural enemy reduces their number—

I find that the eggs are in many cases being destroyed by parasites—or we step in to exterminate them, they will do serious harm the coming spring. I have never found anything equal to the kerosene emulsion to destroy these pests. I use a dilution of one of kerosene to fourteen parts of water, or in other words add to my emulsion a little (more than its volume of water. This will not harm the tender buds indeed, the abundant soap seems to invigorate), but will destroy the eggs if unhatched, and all the lice that it strikes. I prefer to use it just as the buds are opening, as it is more easily applied and is used with more economy before the foliage puts out. It should be applied with a force pump, as dashing it into the trees with force makes the application more thorough and its use more effective.

KEROSENE EMULSION FOR CATTLE LICE, ETC.

In Bulletin No. 7 of the Iowa Experiment Station, Prof. C. P. Gillette reports the destruction of the hog louse, Hæmatopinus suis, by use of the kerosene emulsion. He used a 12½ per cent. emulsion, applied the liquid with a force pump, and reports most excellent success, in not only killing the lice but in destroying the nits, or eggs, as well. Of course, if thought better, the hogs could be washed, by use of cloth or brush, instead of being sprayed with a pump. Such washing would be of service aside from the destruction of the vermin, as the soap solution gives renewed vigor to the skin. In his Bulletin No. 11 the same gentleman reports the same treatment for the sheep tick. An eight per cent. emulsion was used and the sheep were dipped and thoroughly drenched with the emulsion. The remark is made that free oil on top of the emulsion did some injury to the first sheep treated, causing some of the wool to come off. The expense of material was less than two cents per sheep. The man who did the work stood in the vat and received no harm. We shall dip our sheep this spring, using a 12½ per cent. emulsion, and as there will be no free oil we shall expect perfect success and no harm.

In Bulletin No. 5 of the Iowa Experiment Station, Prof. C. P. Gillette detailed some successful experiments in destroying lice on cattle, by use of Kerosene Emulsion. He used an eight per cent. emulsion and applied it by use of a pump the same as for the hogs.

The past winter we have tried this remedy thoroughly and prefer it to our old stand-by, the tobacco decoction as given many times in our reports, and also last year in Bulletin No. 58. The Kerosene Emulsion kills not only the mature lice, but the nits as well, so that it does not need to be repeated so frequently as does even the tobacco decoction. Besides, the soap wash seems to make the hair fresher, and to give a general vigorous appearance to the coat of the animal. We prefer the soft soap emulsion, as we believe the abundance of soap to be beneficial. We diluted the emulsion so that from one eighth to one tenth of the whole was kerosene. At one time we treated thirteen animals whose average weight was 800 lbs. We washed each animal thoroughly. It only took 57 minutes to do the whole. The amount of the liquid used was about ten gallons, and the effect in destroying the lice, and in improving the coat of the animal, was marked.

We found it easier and quicker to wash thoroughly with a brush. This also mats the hair less than does washing with a cloth. We see that the cost is very slight. One gallon of kerosene and two gallons of soft soap,

making the total cost per animal less than five cents and less than five minutes of time. At my request, our herdsman, a very intelligent Scotchman who has spent his entire life with cattle, wrote me the following regarding the effect of this treatment:

PROF. A. J. COOK:

Dear Sir—The kerosene emulsion prepared under your direction and used on the college herd has proved very satisfactory. Of all the remedies for lice which I have tried I prefer this kerosene emulsion. I have used McDougall's dip, carbolic soap, Scotch snuff, tobacco decoction, sulphur and lard, and pyrethrum. It kills the nits, makes the coat glossy, and leaves the skin mellow and clean.

Very respectfully,
JAMES DALZIEL,
Herdsman, Mich. Ag'l College.

As the kerosene emulsion may be kept in the barn ready for use, is so cheap and effective, it leaves little to be desired, and less excuse for lousy cattle.

THE GRAPE PHYMATODES.

Phymatodes amœnus, Say.

Fig. 1—Head of larva c dorsal d ventral view.

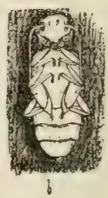

Fig. 2—Pupa.

The past winter one of my students, Mr. L. W. Watkins of Manchester, Michigan, while trimming his grape vines, discovered in the hollowed canes numerous pupæ of some longicorn beetle, which developed and appeared as mature beetles March 18. They proved to be *Phymatodes amœnus*, Say. I have not the larva, but present two drawings (Fig. 1) after Packard, showing dorsal and ventral view of the head. The pupa (Fig. 2) is white and well shown in the figure. The beetle (Fig. 3) is red with dark blue wing covers. The thorax is sub-globular and the elytra sub-rectangular. The antennæ, tibia, and tarsi are dusky. The head, thorax, scutellum, femora, and entire under side of the body are red. The entire insect, even the elytra, is hairy. The femora are strongly fusiform; and a deep groove marks the elytra near the humeral angle. The insects are about eight mm. long, though they are somewhat variable in size.

FIG. 3—Mature Beetle.

In case these borers are sufficiently numerous to harm the vines, resort may be had to winter pruning, care being taken to cut off affected vines, which should be burned. As the insects are in the vines as pupæ in the winter, this action would surely destroy them.

I do not think the beetle has done any considerable damage in the state up to this time.

A NEW BRACONID.

The fall web-worm moth, *Hyphantria cunea*, Dru., is rarely more than single-brooded in Michigan, though last season an early brood was observed. This doubtless was consequent upon the warm winter. In the south the insect is regularly double-brooded. As the caterpillars do not generally

hatch till late in July, or August in the more northern states, they do far less harm than do those insects that defoliate the trees early in the season. Yet this insect does do harm, even where it is only single-brooded, and this, together with the very untidy appearance of trees, which are disfigured by its unsightly webs, make anything connected with its life economy matters of special interest. As this insect works on about one hundred of our fruit and shade trees and shrubs, it is pretty certain to be observed by every one, and to practically interest every person who owns or admires trees and plants.

Dr. C. V. RILEY (see report of entomologist, U. S. department of agriculture for 1886), refers to the following enemies of this insect: Mantis Carolina, Prionidus cristatus, Euchistus servus and Podisus spinosus among predaceous species; and Telenomus bifidus—an egg parasite—Meteorus hyphantriæ, Apanteles hyphantriæ, Limneria pallipes among Hymenopterous parasites, and a species of Tachina. During the past summer Mr. J. C. DUFFEY of the Missouri Botanical gardens, St. Louis, discovered and carefully worked out the entire life history of a Carabid which in Missouri seems to be a very pronounced enemy of this fall webworm. This insect is Plochionus timidus, a rather small Carapid, which is double-brooded and passes through all its changes right in the webs of the caterpillar. Mr. DUFFEY gives the entire life history of this interesting beetle with illustrations.

The past season Mr. C. F. BAKER, one of my students in entomology for whom I name this species, reared another parasite (Fig. 4) from H. cunea which bids fair to do its part in staying the ravages of the insect. This is a small Braconid fly, which I think is undescribed. This insect destroyed the past season at least five sixths of the larvæ of H. cunea which were under investigation. Though a large number spun cocoons, as yet only three males have been reared. As these were kept in a breeding jar, it is possible that some untoward condition destroyed them. Possibly more will yet develop.

In this insect, the mandibles are as usual, clypeus scarcely emarginate, the sutures of the abdomen well marked, second cubital cell large and quadrate, abdomen petiolate and the anterior wings with three submarginal cells. We thus see that this Braconid belongs to the same genus as does one of Dr. RILEY'S species, Meteorus hyphantriæ, which infests this same Hyphantria cunea. As Prof. L. O. HOWARD informs me that this is probably an undescribed species, I append the following description:

METEORUS BAKERI, N. SP. MALE.


FIG. 4—Male Fly.

Yellowish brown, with black markings, shining, pubescent; head yellowish brown; eyes, a square area containing the ocelli, and the occiput black; antennæ pubescent dusky; mouth-parts, whitish; dorsal surface of the prothorax, except a narrow black posterior margin, yellowish brown; pectus, light yellow; mesothorax brown, with a central rectangular area and the lateral lobes shining black; tegulæ, pale yellow, metathorax black, except the tip which is dusky brown, surface reticulated; wings hyaline, iridescent; nervures and stigma dusky, second cubital cell sub-quadrate, broader

posteriorly; the second transverse cubital nervure slightly curved; recurrent nervure, on a line and confluent with intercubital nervure; interno-discoidal cell shorter than externo-discoidal; abdomen smooth, shining, slightly pubescent; petiole shining black, rather heavy, triangular, broadening posteriorly; lateral tubercles slightly developed, upper surface rugose; second segment yellowish brown, broadly margined posteriorly with black; last four segments black, the sutures marked with rows of hairs; entire under parts honey yellow, except petiole and tip of the abdomen, which are black; legs yellow except a terminal spot on each femur, which is quite extended on the posterior femora, a line along the hinder edge of the posterior tibiæ, and the middle and posterior tarsi which are dusky. Length .20 of an inch. Described from three males.

This species seems very near to Meteorus intermedius, Cress., but differs in its dusky scape, brown prothorax, entire absence of spots before the anterior coxæ, one line or spot on central lobe of mesothorax, not two; the spots on femora are wanting in intermedius, and the front tarsi dusky. As all our specimens agree it would seem that this is a separate species.

FIG. 5—Female.

PARASITES ON CURRANT SPAN WORM.

The currant span-worm, Eufitchia ribearia, Fitch, appeared in central Michigan in alarming numbers the past season (1890) for the first time. (See Report State Board of Agriculture, 1890, p. 110.) Though apparently a new comer it was not without enemies from the very first. Upon close examination we found almost as many cocoons of parasites as we found span-worms. These were cocoons of the bright yellow Braconid, Meteorus Communis, Cresson. (Fig. 5.) The larva when full grown comes forth from its victim and suspends its minute oval brownish cocoon to the twigs by means of a fine silken thread. In a few days the fly comes forth to renew the good work of destroying the span-worm.

The fly is about the size of M. Bakeri. It is uniform honey-yellow in color, though in some specimens the antennæ and portions of the feet are dusky. It is described in Canadian Entomologist, Vol. IV, p. 82. From the exceeding numbers of this insect it must have done royal service in depleting the numbers of the span-worms. It prays upon other insects besides the span worm.

THE BEAUTIFUL MESOCHORUS.

From a large number of cocoons which were gathered from twigs where Eufitchia ribearia were feeding, we reared two other parasites, belonging to the family Ichneumonidæ, both of which I think are new species. It is to be hoped that these are parasites on the span-worms, but as the cocoons were so very similar to those of the Braconid last referred to, I fear that these may be parasites on that insect.

MESOCHORUS PULCHELLUS, N. SP.

Fig. 6—Mesochorus pulchellus, Female. Abdomen side view.

This handsome parasite (Fig. 6) belongs to the sub-family Ophioninæ, as the ovipositor is short, abdomen slightly compressed posteriorly and petiolate, and the areolet rhomboidal. The rhomboidal areolet and the exserted ovipositor show that it belongs to the genus Mesochorus.

The color is honey-yellow beautifully marked with black. The antennæ are long and dusky. The tip of the mandibles, compound eyes, and a triangular spot containing the ocelli are black. The center of the mesothorax anteriorly is black and a dusky central line extends back from this nearly or quite to the scutellum. The lateral margins of the mesonotum are black.

The scutellum is margined with black, and a V-shape black spot marks the metathorax. The tegulæ are light yellow. The wings are hyaline, iridescent, stigma and nervures black. The base of the nervures are light yellow. The legs are light yellow. The posterior tibiæ have each a black spot at each end. The abdomen is spindle-shape, rather slender at the base. The first segment is wholly black, triangular, narrowest at the base. The second segment has a black V-shape spot at the base, while the anterior angles and a broad semicircle at its posterior margin are yellow. The third segment has a broad black posterior crescent, which reaches anteriorly to the angles. The three posterior segments are yellowish brown, and the fifth and sixth are dusky on the posterior border. The ovipositor is black. Entire under parts light yellow. Length three thirty-seconds of an inch.

The species is quite like Mesochorus Americanus, Cress. (Canadian Entomologist Vol. IV, p. 23). It differs in its yellow mesothorax, dusky antennæ, black nervures, and stigma, black spot at base of posterior tibiæ, and in the black markings on the dorsal surface of the abdomen.

THE BLACK-HEADED ISCHNOCERUS.

The other species which we reared from the cocoons formed by parasites from Eufitchia ribearia was also an Ichneumon fly. In this species the ovipositor is exserted, quite long, areolet is incomplete, the parasidal grooves of the mesothorax distinct, and the gostrocœli wanting. Thus this species belongs to the sub-family Cryptinæ.

The areolet is absent, the first abdominal segment expanded at the apex, and the spiracle is behind the middle. There are two transverse carinæ on the metathorax, and the abdomen is not broader than the thorax. Thus our species belongs to the genus Ischnocerus. Mr. Cresson gives this as a genus with no described American species.

ISCHNOCERUS NIGRICAPITATUS, N. SP. FEMALE.

Fig. 7—Female. Abdomen side view.

The color is black marked with brown. The head is smooth, shining black with a very fine pubescence. The antennæ (Fig. 7) are long, recurved, and slightly enlarged toward the ends. Each antennæ has twenty-seven joints. The scape and the two or three following joints are honey, yellow, but each succeeding joint is more dusky The entire club is dusky. The labrum is yellowish, mandibles brown, and the palpi whitish. The entire thorax, like the head, is intense black. The parapsidal grooves are distinct. The mesothorax has very fine transverse striæ, and is finely pubescent. The metathorax is sub-quadrate, faintly rugulose, and pubescent. The tegulæ are whitish; the wings hyaline, iridescent, and slightly pubescent. The venures and stigma are dusky, except at base where they are whitish; legs yellowish brown except knees and tip of last tarsi which are dusky. The abdomen is petiolate, broad, and hairy. The first segment is black, longitudinally striate, and broadens abrubtly beyond the middle. The second, third, and fourth segments are brown. The lateral margins of the second and the broad lateral and narrow posterior margins of the fourth are dusky. The fifth and sixth segments are dusky, with a slight posterior brownish border. The ovipositor is brown, the guides black. Length three thirty-seconds of an inch.

THE PEACH LOUSE—APHIDIUS.

The past season—1890—the common peach-louse, Myzus persicæ, was a serious pest in many parts of Michigan. This well-known aphis is only one twelfth of an inch long. The body is greenish black, marked with black. The antennæ are black and the abdomen and legs yellowish brown, the latter marked with black. These lice work on the under side of the leaves which they cause to roll up or curl. The leaves become pitted beneath and bunched above, and soon fall from the trees. The past season one of my pupils, Mr. C. F. Baker, reared a large number of Braconid parasites from these lice. The parasites served greatly to reduce the number of lice, and it is to be hoped that they will prove as efficient as did the closely related Aphidius granariaphis in clearing the grain fields of the grain louse in the summer of 1889. This proves to be a new species so far as I can ascertain.

In this species the abdominal segments are quite freely movable, so that the abdomen bends readily under the thorax. The venation of the posterior wings is very simple, indicating the sub-family Aphidiinæ. The first discoidal cell is incomplete. The abdomen is lanceolate, the antennæ fifteen-jointed, and so we have the genus Aphidius.

APHIDIUS PERSIAPHIS, N. SP.—MALE.

This species (Fig. 8.) is black with scattering lightish hairs. The head is smooth, shining black, and very slightly hairy. The compound eyes and


Fig. 8—Male.

ocelli are prominent and intense black. The antennæ are black with fifteen joints. The first two are rounded, the remaining ones elongated. The palpi are whitish yellow. The entire thorax is shining black. The wings are transparent and iridescent. The venures and stigma are dusky. The front legs are yellow, the middle ones yellow or dusky, the posterior ones usually dusky. All the legs have a yellowish tinge and may vary between yellow and dusky. The first joint or petiole of the abdomen is yellow, the remaining segments black or dusky. Underneath the thorax is black, the abdomen yellowish, becoming dusky or black toward the tip. The length is one sixteenth of an inch. Described from several specimens.

PARASITES ON HETROCAMPA SUBALBICANS.

The common linden caterpillar, Heterocampa subalbicans, Grote, was exceptionally common in central Michigan in 1890. This gray moth, variously marked with black and white, lays her eggs on basswood and elm. The larvæ, which are often very common in autumn, are wondrously beautiful and varied. The combination of delicate green and brilliant red is exquisite.

During the past autumn, we found about the larvæ on the leaves, symmetrically arranged, often in a circle, groups of pupæ of some parasite. These pupæ were remarkable for their abundance, their style of arrangement, and for a mass of fecal matter adjacent to each one. Thus they formed curious objects, and though so minute, attracted the attention of several of my students.

From these pupæ, which in some cases we derived from the larvæ, we reared two very interesting chalcid parasites, a few black ones, of the genus Cratotechus, which I think were probably the real parasites of the caterpillar, and many more beautiful, shining metallic green of the genus Derostenus. In several cases we reared only species of these latter, though in many cases we got both species and both sexes from the same group of pupæ.

THE BEAUTIFUL DEROSTENUS.

The nine-jointed antennæ, four-jointed tarsi, broken sub-marginal vein, narrow costal cellure, short post-marginal and stigmal veins, single spur to the posterior tibiæ, two bristles to the sub-marginal vein, small metapleura, and double bristles on the mesoscutellum, determine the sub-family Entedoninæ, as given by Howard in his synopsis (Entomologica Americana Vol. 1, p. 198).

The funicle of the male antennæ is not toothed, the mesoscutellum has no median furrow, wings with no appearance of cells, even from the arrangement of hairs; post marginal vein unbroken, abdomen short, and antennæ nine-jointed; thus we know that this resplendent Chalcid belongs to the genus Derostenus (see Howard's Synopsis Entomologica Americana Vol. 2, p. 100).

DEROSTENUS SPLENDENS, N. SP. (FIG. 9).

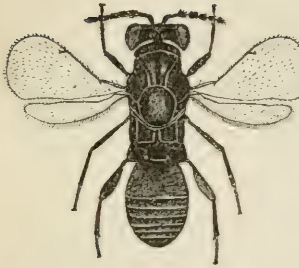

Fig. 9.

Shining metallic green. The head is broad, and like nearly the whole body finely imbricated, which produces the beautiful iridescence sparsely covered with short white hairs. Ocelli and compound eyes purplish black and prominent, the latter bearing short, stiff hairs. The antennæ are nine-jointed. The first four joints are small, smooth, and the third and fourth or ring joints very short. The other joints are moniform, hairy, and subequal, the last one elongate, tapering to the end. A shallow declivity on the front receives the antennæ.

The thorax is broad and quadrangular. Besides the short hairs there are bristles, six on the prothorax, two pairs on the mesoscutum, and smaller ones on the metathorax. The prothorax is narrow and crescent-shape. The parapsidal grooves and a central longitudinal depression mark the mesoscutum. The scutellum is rounded and prominent. The post-scutellum is narrow. The metathorax has two lateral sub-quadrangular elevations, and a narrow posterior extremity where it joins the abdomen. The wings are beautifully iridescent and slightly hairy. The sub-marginal vein is broken close to the base and bears two bristles. The post-marginal and stigmal veins are very short. The legs are green except the tarsi, the first three joints of which are white and the last black in all the feet.

The anterior legs have the femora slightly curved, fusiform, a very little longer than the tibiæ. The tibiæ bear each a short spur. In the middle legs the femur is slender. The posterior legs have very large sub-globular coxæ and fusiform femora. All the legs are slightly hairy. The abdomen is short and heavy. The first segment is long, the other six short and subequal. Length, one and one fourth mm. or .05 of an inch. Described from many specimens.

Since writing the above we have reared, April 14, 1890, several more of this species from the same peculiar groups of pupæ, which came from the oak caterpillar, Edema albifrons, and which passed the winter as pupæ.

The other species, bred from the groups of pupæ, though not so numerous, were also quite common. We bred several specimens of both sexes.

THE SHORT-HEADED CRATOTECHUS.

This species belongs to the same section as does the Derostenus. The antennæ in the female are obviously six-jointed. If there be other joints they are very obscure. The tarsi are four-jointed, the prothorax prominent, mesoscutellum with four bristles, sub-marginal vein not broken, post-marginal distinct, petiole short and obscure (it is usually marked in this sub-family), parapsides absent, the posterior coxæ not large, post-marginal and stigmal veins quite long. Thus we have the sub-family Eulophinæ. The scutellum is without dorsal lines, antennæ are inserted low down, parapsidal sutures wanting, posterior tibiæ with two spurs, marginal veins less than three times as long as the stigmal, antennæ of the male three-branched. Thus we have the genus Cratotechus:

CRATOTECHUS BREVICAPITATUS, N. SP.—FEMALE.

FIG. 10—Female.
a, Antenna of Male.

Color black, with a bronze or greenish reflection, coarsely pitted resembling the outside of a thimble, slightly hairy. The hairs are short, and whitish. The head is wide transversely, (Fig. 10) but very narrow from before back, the vertex being a mere ridge. The front is excavated for the antennæ. Two ocelli are situated on the edge of the apex, one in front and below. The compound eyes are oval, elongated from above downward, broadest below. They are mottled with light and brown. The antennæ are inserted low down on the front. The scape reaches nearly to the tip of the vertex, it and the last joint of the antennæ are white, the other joints are dark. The second joint is small, third, fourth and fifth sub-equal, sixth elongated and tapering.

The prothorax is broad, and narrow from before back; the anterior and posterior margins parallel. The mesothorax is prominent, parapsidal grooves absent, lateral lobes distinct, the scutellum prominent; lateral white bristles margin the metathorax, and four black ones mark the mesoscutellum. The post-scutellum and metathorax are wide and narrow from before back, the latter narrowed posteriorly to join the abdomen. The wings are transparent, iridescent, slightly clouded in the center. The basal half of each wing is nearly bald, the outer hairy; the sub marginal and marginal veins are nearly equal, the post-marginal and stigmal rather long and subequal. The posterior wings have an angle in the sub-marginal vein which is about equal to the marginal. Short bristles project from the latter. A rim of short hairs fringe this wing as they do the margin about the internal angle of the anterior wing. The secondary wings are nearly bald to the end of the sub-marginal vein. The anterior legs are black to tip of femora, though the trochanters are dusky. From the tip of the femora all is whitish except the claws which are black. The femora are fusiform, the tibial spurs distinct but short. The middle legs are colored the same as the anterior, but the femora are longer, more slim, and the tibial spurs much longer. The posterior coxæ and the femora except at tips, are black; all the remainder of these legs are whitish except the black claws. The posterior femora are quite fusiform, slighthly longer than the middle, and there are two tibial spurs one shorter than the other. The middle and posterior legs are considerably longer than are the anterior. The abdomen is short, broad, oval, and deeply excavated above. The petiole is short and obscure. The first joint is yellowish white above, except at the margin or rim of the excavation; all else is bronze-black. The last five joints are short. Beneath, wholly black, except a few specimens are straw-colored at the base of the abdomen. Length slightly more than two mm. Described from many specimens.

THE MALE.

In the male the antennæ (Fig. 10a) are not only three-branched, but they are seven-jointed. The branches are very hairy and arise at the bases of the third, fourth, and fifth joints. The scape is more dusky and the funicle and club much lighter colored than in the female. In some specimens these

latter are nearly white except a black annulation at the union of the joints. The hairs on the antennæ, especially on the three branches, are more numerous and longer in the males than in the females. The anterior and middle legs are lighter colored in the males than in the females. The anterior femora are nearly all white, and the middle one dusky. A prominent spur near the end of the middle femora marks both sexes.

The abdomen is much narrower and smaller in the male, and the yellowish spot on the first segment is much abbreviated. The length of the male is a little less than two mm. Described from several specimens.

A UNIQUE PARASITE.

The past summer, 1890, a new rustic bridge was built over the small brooklet that cuts across the college campus. The railings of this bridge were made of American larch or tamarack. About July 20, these tamarack timbers were found to be full of nearly mature grubs of two species of bark beetle: Polygraphus rufipennis, Kirby, and Dendroctonus similis, Lec. We not only reared a large number of both species of these beetles, but also a number of most interesting parasites, which are very unique in form and proportions, and wholly unlike anything else in our collection.

I have not the description of the genus or the unique Chalcid, but I am indebted to Prof. L. O. Howard for the generic determination, and also for the information that there are no American species of the genus described.

HEYDENIA UNICA, N. SP.—MALE.

FIG. 11—Male.—*a*, Antennæ of female. *b*, Antennæ of male.

Color, dark metallic blue, with brassy or purplish reflection. Nearly every portion beautifully reticulated, sparsely covered with short hairs. Head (Fig. 11) broad. vertex broad from before back. A V-shape groove with the angle above extends from the base of antennæ toward the vertex, and reaches to near the anterior ocellus. The clypeal suture, and the sutures separating the genæ from front, distinct. Area close about mouth, yellowish brown. Ocelli and eyes intense black; the latter elliptical in form. Antennæ black, hairy, and long, reaching to the end of the thorax. (They are too short in the figure.) The scape is yellowish beneath, and is as long as the head from the jaws to the vertex. The second joint of the antennæ is short, the third very short, the fourth is nearly as long as the scape. The following joints shorten to the seventh. The remaining joints—eighth to thirteenth—are subequal and form a slight club. Thus the antennæ are slightly clavate. The jaws are black, palpi long, dark, and hairy.

The prothorax is very long, half as long as the mesothorax and metathorax together. It is broadest in front, narrows abruptly to join the head, and is excavated on the sides, looking like a concave roof, the ridge being quite broad. It is purplish blue above, and lighter beneath. The mesothorax is broad, prominent, parapsidal grooves distinct; lateral lobes prominent, scutellum large and very convex; mesothorax hardly as broad as the

head. The post scutellum is a mere line. The metathorax narrows slightly behind. A sharp, black, central longitudinal ridge separates the metathorax into two equal portions. Its posterior angles show a brush of stiff, light-colored hairs. The wings are large, iridescent, and conspicuously clouded, with three spots. The outer cloud is largest and densest and extends back from the stigmal vein. The other clouded spots extend backward from the angle, and from near the extremity of the sub-marginal vein. A thick group of scale-like hairs mark the veins where the clouded spots touch them. A clouded line behind the clouded spots runs nearly parallel with the internal margin of the wing. The costal cell is distinct, and is symmetrically divided by cross scales. The sub-marginal vein is about twice as long as the marginal The post-marginal and stigmal are rather short, the former being the longer. A portion of the posterior margin of the wing is quite thickened so as to resemble a vein. The outer margin and internal angle are fringed with short hairs. The secondary wings are clear and beautifully iridescent, broad lines of different colors running lengthwise of the wings, and these are cut across with diagonal striæ. The sub-marginal vein reaches to the middle of the wing. The costal cell is fringed at its middle with hairs, as is the whole internal margin of the wings. The legs are dark along the front, and brownish behind. The anterior coxæ are dark blue with a purple reflection; the anterior femora are green and very large. A deep groove marks these large femora on the inner side to receive the tibiæ. One margin of this groove is finely serrate. All the coxæ are large. One tibial spur marks the anterior and posterior legs, and two the middle. The tibiæ are margined with stiff hairs. First joint of tarsi, long, white, the three following equal and all together as long as the first. The second to the fifth joints inclusive are white, except the tips of the fourth and fifth which are dusky; claws dark.

The abdomen is petioled, broadened posteriorly, and about as wide as the metathorax. First joint is narrow and brownish yellow, the second broader, blue black, tipped with yellow. The remaining joints are dark blue. The fourth and fifth joints are broadest and longest. The insect is dark blue beneath, except the prothorax and petiole of the abdomen, which are yellowish brown. Length, five mm. Described from two specimens.

The female differs from male in size, the antennæ, prothorax, wings, and abdomen. The antennæ are much shorter, reaching only to the mesothorax, and are more clavate. The joints are the same in number--thirteen—but the separate joints are shorter. The prothorax is a little smaller, broader at the ridge, and a little less roof-like. The wings are less clouded; the two inner spots are very obscure or wholly wanting. The abdomen is almost sessile, nearly oblong, and gradually narrowed at the base. The first joint is yellow, the remaining six joints blue-black. Length, four mm. Described from many specimens.

We wish to acknowledge valuable assistance rendered by Dr. C. V. Riley, Prof. L. O. Howard, and also to Mr. F. J. Niswander who made part of the drawings.

A. J. COOK.
G. C. DAVIS.

INSPECTION OF COMMERCIAL FERTILIZERS.

By Prof. R. C. KEDZIE. Bulletin No. 75, July, 1891.

The law regulating the inspection and sale of commercial fertilizers in this state does not seem to be understood on the part of manufacturers and dealers. There are so many misapprehensions on the subject, the law is reprinted for information of the public.

[Session Laws of 1885, No. 26.]

AN ACT to provide for the inspection of commercial fertilizers and to regulate the sale thereof.

SECTION 1. *The People of the State of Michigan enact*, That any person or persons who shall sell or offer for sale in this State any commercial fertilizer, the retail price of which exceeds ten dollars per ton, shall affix on the outside of every package containing such fertilizer a plainly printed certificate, stating the number of net pounds therein; the name or trade mark under which such article is sold; the name of the manufacturer; the place of manufacture, and a chemical analysis, stating the percentage of nitrogen in an available form; of potash soluble in water and of phosphoric acid in available form (soluble or reverted) and the insoluble phosphoric acid.

SEC. 2. Before any commercial fertilizer is sold or offered for sale, the manufacturer, importer or party who causes it to be sold or offered for sale within this State, shall file with the secretary of the State Board of Agriculture a certified copy of the analysis and certificate referred to in section one, and shall also deposit with said secretary a sealed glass jar containing not less than two pounds of such fertilizer, with an affidavit that it is a fair sample of the article thus to be sold or offered for sale.

SEC. 3. The manufacturer, importer, or agent of any commercial fertilizer, the retail price of which exceeds ten dollars per ton as aforesaid, shall pay annually to the secretary of the State Board of Agriculture, on or before the first day of May, a license fee of twenty dollars for each and every brand of fertilizer he offers for sale in this State: *Provided*, That whenever the manufacturer or importer shall have paid this license fee his agents shall not be required to do so.

SEC. 4. All such analyses of commercial fertilizers required by this act shall be made under the direction of the State Board of Agriculture and paid for out of the funds arising from the license fees provided for in section three. At least one analysis of each fertilizer shall be made annually.

SEC. 5. The secretary of the State Board of Agriculture shall publish in his annual report a correct statement of all analyses made and certificates filed in his office; together with a statement of all moneys received for license fees, and expended for analysis. Any surplus from license fees remaining on hand at the close of the fiscal year shall be placed to the credit of the experimental fund of said board.

SEC. 6. Any person or persons who shall sell or offer for sale any commercial fertilizer in this State without first complying with the provisions of sections, one, two, and three of this act, or who shall attach or cause to be attached to any such package or fertilizer an analysis stating that it contains a larger percentage of any one or more of the constituents or ingredients named in section one of this act than it really does contain shall, upon conviction thereof, be fined not less than one hundred dollars for the first offense, and not less than three hundred dollars for every subsequent offense, and the offender shall also be liable for damages sustained by the purchaser of such fertilizer on account of such misrepresentation.

SEC. 7. The State Board of Agriculture by any duly authorized agent is hereby authorized to select from any package of commercial fertilizer exposed for sale in this State, a quantity, not exceeding two pounds, for a sample, such sample to be used for the purposes of an official analysis and for comparison with the certificate filed with the secretary of the State Board of Agriculture and with the certificate affixed to the package on sale.

SEC. 8. All suits for the recovery of fines under the provisions of this act shall be brought under the direction of the State Board of Agriculture.

Approved March 10, 1885.

This is the law of the state on this subject, and the only duty of the college authorities is to see its provisions and regulations properly carried out. It was designed primarily to protect the farmers from loss by buying poor and even worthless fertilizers at high prices. It has driven some inferior goods out of our market and saved thousands of dollars to our people. It has also improved the quality of many fertilizers sent into our state, and tends to keep all manufacturers up to the quality claimed for their goods. Michigan is no longer the dumping ground for fertilizers of so poor quality as to be unsalable in other states.

In these analyses attention is directed exclusively to nitrogen, potash and phosphoric acid in form available for the plant. These are not the only materials concerned in raising crops, but they are the only manurial materials for which the farmer can afford to pay more than ten dollars a ton. The common soil materials, lime, magnesia, silica, alumina, oxide of iron, etc., make up the bulk of our soils, which the farmer cannot afford to buy at twenty to thirty dollars a ton to manure his fields made up of the same materials. These common soil materials aside from nitrogen, potash and phosphates do not enter into consideration in making up an estimate of the value of any fertilizer.

OBJECT OF INSPECTION OF COMMERCIAL FERTILIZERS.

The law does not prescribe any standard for the composition of a commercial fertilizer, the manufacturer being free to make his own standard, the law simply requiring that the fertilizers offered for sale shall be up to the standard set up by the manufacturer. The license to sell does not certify to the value of the fertilizer, but simply states that the manufacturer or dealer offers for sale a fertilizer for which a certain content of nitrogen, potash and phosphoric acid is claimed, and that samples of such fertilizers have been deposited with the secretary of the college with affidavit regarding the composition. Analysis is then made of each of chese fertilizers, gathered in the open market as far as possible, and the results of such analysis published in bulletin. The *claimed* composition and *found* composition are arranged in parallel lines so that the real composition can be compared at a glance with the composition claimed for it by the manufacturer. In this way the buyer can see at once by this bulletin whether the fertilizer is as good as it claims.

To find the market value, calculations can be made on the basis that available nitrogen is worth nineteen cents a pound, soluble or available phosphoric acid eight cents, insoluble phosphoric acid two cents, and potash from four and one-half to six cents, according as it is in the form of chloride or sulphate. These prices are determined each year by the prices of substances from which these materials are derived in the great commercial centers, *e. g.*, New York.

The composition is given in parts in one hundred. To obtain the number of pounds in a ton we multiply the per cent by twenty. If we multiply the number of pounds in a ton by the price of each material the sum will give the value of a ton of fertilizer. Take an example in a superphosphate made in this State.

Ammonia	2.99 % × 20=59.8 ℔ in ton, @ 19c=	$11.36
Available phosphoric acid	8.02 % × 20=160.4 ℔ @ 8c=	12.83
Insoluble phosphoric acid	2.24 % × 20= 44.8 ℔ @ 2c=	.90
Potash soluble in water	1.68 % × 20= 33.6 ℔ @ 6c=	2.02
Market value, equals		$27.11

The whole value of a ton of superphosphate seems to be determined by a little less than 300 pounds of the material. The remaining 1,700 pounds may be considered as made up as follows:

The 205 pounds of phosphoric acid would require 447½ pounds of bone phosphate, or tricalcic phosphate, and this converted into superphosphate and sulphate of lime would make 782½ pounds of lime salts	782.5
The nitrogen would require 374 pounds albumenoids	374.0
The potash as sulphate	66.5
Bones contain 25% carbonate, etc., of lime, as sulphate	350.0
Moisture and excess of sulphuric acid	195.0
Total	1,768.0
Dirt, charcoal, etc.	232.0
	2,000.0

Result of Analysis of Commercial

Manufacturer.	Trade Name.	Dealer and Locality.
Crocker's Chemical Works, Buffalo, New York	Practical Ammoniated Superphosphate	Guy Kimbal, Port Huron
Crocker's Chemical Works, Buffalo, New York	New Rival Ammoniated Bone Superphosphate	North & Parr, Burr Oak
Crocker's Chemical Works, Buffalo, New York	Vegetable Bone Superphosphate	Guy Kimbal, Port Huron
Crocker's Chemical Works, Buffalo, New York	Potato Hop and Tobacco Phosphate	Seth Lathrop, Richmond
Crocker's Chemical Works, Buffalo, New York	Ammoniated Bone Superphosphate	Seth Lathrop, Richmond
Crocker's Chemical Works, Buffalo, New York	Bone Meal	J. M. Isabell, Jackson
Crocker's Chemical Works, Buffalo, New York	Ammoniated Wheat and Corn Superphosphate	H. S. Church, Sturgis
Crocker's Chemical Works, Buffalo, New York	Buffalo Superphosphate No. 2	John Wallace, St. Joseph

If we take a fertilizer with one per cent of insoluble phosphoric acid, three per cent soluble potash and no available nitrogen, the commercial value as estimated above would be $4.00 a ton. If it had only one-tenth these amounts the value would be 40 cents a ton if estimated in the same way.

Farmers can easily estimate the commercial value of fertilizers by using these data.

LICENSE REQUIRED.

A license is required from each dealer who sells or offers for sale any commercial fertilizer, the price of which exceeds ten dollars a ton. This license must be taken out each year for each brand of fertilizer offered for sale. The amount sold is not contemplated by the law. The lawful sale of any amount will require a license. The license is for one year in each case, commencing with the first of May. The application for a license, the fee for the same ($20), and the specimens of fertilizers, with the affidavit, should be sent to Secretary H. G. Reynolds, at the college, by the 1st of May each year.

R. C. KEDZIE,
Chemist Experiment Station, Agricultural College.

Fertilizers in Michigan for 1891.

Composition of Fertilizers as Claimed by Manufacturer and as Found on Chemical Analysis.
Percentage Estimation.

	Available Nitrogen.	Phosphoric Acid.			Potash.—Soluble in Water.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	1 to 2	8 to 10	1 to 2	9 to 12	1.08 to 1.60	-----
Found	.95	7.74	2.18	9.92	1.12	2.07
Claimed	1.50 to 2.50	10 to 12	1 to 3	11 to 15	1.60 to 2.70	3 to 5
Found	1.83	7.25	3.23	10.48	2.08	4.04
Claimed	6 to 7	6 to 7	1 to 2	7 to 9	6 to 8	11 to 15
Found	5.76	5.40	1.48	6.82	7.80	14.41
Claimed	2.50 to 3.50	10 to 12	1 to 2	11 to 14	3.25 to 4.30	6 to 8
Found	2.21	8.09	1.66	10.98	3.30	6.10
Claimed	3.50 to 4.50	10 to 12	1 to 2	11 to 14	1 to 2	2 to 3
Found	3.28	9.03	3.81	12.84	1.17	2.16
Claimed	3.50 to 4.50	-----	-----	25	-----	-----
Found	5.32	-----	-----	22.36	-----	-----
Claimed	2.50 to 3.50	10 to 13	1 to 2	11 to 15	1.60 to 2.70	3 to 5
Found	2.52	6.88	2.76	9.64	2.10	3.88
Claimed	-----	11 to 13	1 to 2	12 to 15	1.35 to 2.	2.50 to 3.50
Found	-----	12.94	0.82	13.76	1.33	-----

Result of Analysis of Commercial Fertilizers

Manufacturer.	Trade Name.	Dealer and Locality.
Crocker's Chemical Works, Buffalo, New York	Niagara Phosphate	Manufacturer
Crocker's Chemical Works, Buffalo, New York	Queen City Phosphate	Manufacturer
Crocker's Chemical Works, Buffalo, New York	Special Potato Manure	Manufacturer
Michigan Carbon Works, Detroit	Homestead Superphosphate	C. A. Slayton, Tecumseh
Michigan Carbon Works, Detroit	Homestead Potato Grower	C. B. Waterloo, Port Huron
Michigan Carbon Works, Detroit	Banner Raw Bone Flour	John Gardner, Oxford
Michigan Carbon Works, Detroit	Jarves Drill Phosphate	G. R. Lovejoy, Lenox
Michigan Carbon Works, Detroit	Jarves Celery Grower	Geo. Hancock, Grand Haven
Northwestern Fertilizer Company, Chicago, Ill.	$26 Phosphate	Lawrence & Stafford, Romeo
Northwestern Fertilizer Company, Chicago, Ill.	Garden City Superphosphate	Castor, Mallory & Co., Flint
Northwestern Fertilizer Company, Chicago, Ill.	Celery Grower	C. A. Slayton, Tecumseh
Northwestern Fertilizer Company, Chicago, Ill.	Prairie Phosphate	Castor, Mallory & Co., Flint
Northwestern Fertilizer Company, Chicago, Ill.	Fine Raw Bone	Lawrence & Stafford, Romeo
H. S. Miller, Newark, N. J.	Harvest Queen	J. M. Hicks, Richmond
H. S. Miller, Newark, N. J.	Chanticleer	J. M. Hicks, Richmond
H. S. Miller, Newark, N. J.	Ground Bone	W. A. Hays, Rochester
Cleveland Dryer Co., Cleveland, Ohio	Buckeye Ammoniated Bone	T. Hazelton, Romeo

in Michigan for 1891.—CONTINUED.

Composition of Fertilizers as Claimed by Manufacturer and as Found on Chemical Analysis. Percentage Estimation.

	Available Nitrogen.	Phosphoric Acid.			Potash.—Soluble in Water.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	----------	11.50 to 13.00	1 to 3	12.50 to 16.00	----------	----------
Found	----------	14.76	0.92	15.68	----------	----------
Claimed	2 to 2.50	8 to 12	1 to 2	9 to 14	1 to 2	2 to 4
Found	2.36	9.59	1.29	10.88	2.18	4.03
Claimed	4.50 to 5.50	8 to 9	1 to 2	9 to 11	5.50 to 6.50	10 to 12
Found	5.41	7.72	3.06	10.78	6.41	11.86
Claimed	1.85 to 2.40	7.50 to 11	----------	7.50 to 11	----------	2.75 to 3.50
Found	2.55	8.67	0.83	9.50	1.68	3.10
Claimed	3 to 4	8 to 11	----------	8.50 to 12.50	----------	6.50 to 7.50
Found	3.60	10.92	0.27	11.19	4.37	8.07
Claimed	3.75 to 4.75	----------	----------	18 to 23	----------	----------
Found	4.21	----------	----------	20.28	----------	----------
Claimed	1.25 to 2.	7.50 to 9.50	2 to 3	9.50 to 12.50	----------	----------
Found	1.27	8.04	1.31	10.54	----------	----------
Claimed	1	----------	----------	1	1	----------
Found	1.96	----------	----------	11.91	1.23	----------
Claimed	2 to 2.50	----------	----------	9 to 11	----------	----------
Found	2.51	----------	----------	13.53	----------	----------
Claimed	2.50 to 3	8 to 9	4 to 4.50	12 to 13.50	.54 to 1.08	----------
Found	2.58	10	4.42	14.42	1.38	----------
Claimed	3 to 4	7 to 9	----------	7 to 9	----------	2 to 3
Found	3.82	6.44	----------	11.00	----------	4.16
Claimed	2 to 2.50	6 to 8	9 to 11	15 to 19	----------	----------
Found	2.31	6.95	6.71	13.66	----------	----------
Claimed	3 to 4.	----------	----------	22 to 24	----------	----------
Found	4.52	----------	----------	21.41	----------	----------
Claimed	1 to 2	10 to 12	----------	----------	----------	----------
Found	1.40	7.29	----------	8.62	----------	----------
Claimed	1 to 1.50	6 to 7	1 to 2	7 to 9	2.50 to 3	----------
Found	1.63	2.45	1.50	8.95	2.99	----------
Claimed	2 to 3	----------	----------	12 to 14	----------	----------
Found	3.06	----------	----------	21.36	----------	----------
Claimed	3 to 4	9 to 10	2 to 3	11 to 12	1 to 2	----------
Found	2.43	9.51	2.73	12.24	.46	----------

Result of Analysis of Commercial Fertilizers

Manufacturer.	Trade Name.	Dealer and Locality.
Cleveland Dryer Co., Cleveland, Ohio	Ohio Seed Maker	E. W. Spenser, Petersburg
Cleveland Dryer Co., Cleveland, Ohio	Square Bone	B. E. Niles, Blissfield
Cleveland Dryer Co., Cleveland, Ohio	Ammoniated Dissolved Bone	W. A. Curtis, Rochester
Cleveland Dryer Co., Cleveland, Ohio	Potato Fertilizer	E. W. Spenser, Petersburg
Jarecki Chemical Works, Sandusky, Ohio	Lake Erie Fish Guano	Chas. Crane, Adrian
Jarecki Chemical Works, Sandusky, Ohio	Superphosphate	Chas. Crane, Adrian
W. S. Dunbar, St. Joseph	Meat and Bone Fertilizer	S. M. Austin, Benton Harbor
W. S. Dunbar, St. Joseph	Fish Guano	John Wallace, St. Joseph
Michigan Beef and Provision Co., Detroit	Farmers' Favorite	Geo. E. Breck, Paw Paw
Joseph Lister, Chicago, Ill.	Azotine	Farnum & Morton, Benton Harbor
Joseph Lister, Chicago, Ill.	Fine Bone Meal	Farnum & Morton, Benton Harbor
Bradley Fertilizer Co., Boston, Mass.	Ground Bone with Potash	Wm. Cox, Plainwell
Pottstown Iron Co., Pottstown, Pa.	Odorless Phosphate	Martin Bros. & Co., Port Huron
Listers' Agricultural Chemical Works, Newark, N. J.	Lister's Success	A. & H. Wilcox, Jackson
Western Union Chemical Company, Cleveland, Ohio	Ohio Farmers' Bone Superphosphate	Manufacturer

in Michigan for 1891.—CONCLUDED.

Composition of Fertilizers as Claimed by Manufacturer and as Found on Chemical Analysis. Percentage Estimation.

	Available Nitrogen.	Phosphoric Acid.			Potash.—Soluble in Water.	
	Estimated as NH_3.	Available P_2O_5.	Insoluble P_2O_5.	Total P_2O_5.	Estimated as K_2O.	Estimated as K_2SO_4.
Claimed	1.50 to 2.50	10 to 12	3.19	15 to 17		
Found	1.36	9.73	3.19	12.92		
Claimed	3 to 4	6 to 10	14 to 15	20 to 25		
Found	4.34	10.50	7.50	18.00		
Claimed	1.50 to 2.50	10 to 12		15 to 18		
Found	1.22	10.10	2.85	12.95		
Claimed	4 to 5	8 to 10	2 to 4	10 to 14	4 to 6	
Found	1.97	8.90	3.21	12.11	0.92	
Claimed	2 to 3	11 to 12	1 to 2	12 to 14	1 to 2	
Found	1.21	10.03	4.14	14.17	1.15	
Claimed						
Found	1.31	6.38	4.42	10.80	1.15	
Claimed	6.24			16.00		
Found	5.47			12.92		
Claimed	6.75			14.00		
Found	7.80			5.78		
Claimed	4.96			5.97		
Found	4.87			5.47		
Claimed	14.90					
Found	14.19					
Claimed	3.05			24.65		
Found	4.54			21.56		
Claimed	1 to 2	6 to 8		10 to 12	4 to 6	
Found	1.51	8.75	1.02	9.77	3.70	
Claimed		4.92	15.95	20.87		
Found		3.68	16.78	20.46		
Claimed	1.25 to 2			10.50 to 12	*1.50 to 2	
Found	1.95	8.00	2.60	10.60	1.58	
Claimed	1.50 to 2.50	9 to 12	3 to 5	12 to 15	1 to 2	
Found	2.24	10.12	3.78	13.90	0.14	

REPORT OF APIARY FOR 1891.

By Prof. A. J. Cook, Oct. 1, 1891. Michigan Experiment Station.

The following report is a duplicate of the report of experiments made for the U. S. department of agriculture under an arrangement made with them in the autumn of 1890. The report was made to Dr. C. V. Riley, the chief of the division of entomology.

The past season has been very unfavorable for apicultural experiments, not only in Michigan but throughout the entire country. The secretion of nectar from clover, and indeed from nearly all other honey plants, was very meagre indeed. In Michigan the season has been peculiar for drouth and cold. The exceptionally cool temperature has been very general throughout the country, while in many sections there has been an excess of rainfall.

As the honey production has been very light in nearly all sections, it would seem that the low temperature might be the chief cause of the light honey crop for this season.

SPECIAL PLANTING FOR HONEY.

The experiments this season have been a continuation of those of the past three years. The aim was to determine whether it would be profitable or not to plant solely with the view of increasing the acreage of honey plants and so the production of honey.

As the expense of planting, use of land, and danger of failure to secure a crop are considered, we see that unless a field of plants which have no value except for honey is almost sure to give us honey with but little care after planting, and to hold its own against weeds, drouth, and all discouragement, it will not pay the expense incurred in planting it.

THE CHAPMAN HONEY PLANT.

As this plant has been very highly extrolled, was lauded by a special committee selected to examine it, and has been widely distributed by the government, it was considered a very desirable plant for experiment. Quite a large area was planted to this *Echinops sphærocephalus* on two successive years. The soil was clay loam. The ground was fitted as well as for corn, the seed sown in drills and cultivated the first season. The plants came up well and grew very well. It never blossoms until the second season, so there are no returns the first year. This is the first serious objection to the plant as a honey plant. The second summer they blossom full, and are very vigorous and the blossoms very numerous. The bees seemed to visit the flowers very freely. Mr. Th. W. Cowan, the celebrated apiarist of England, said to me some years since regarding this plant: "The bees hang around it persistently, but I could never see that the gain in honey in the hive was perceptible." I found the same true here. Actual weighing showed very little gain, nor was our honey crop superior to that of neighbors with no *Echinops* within the range of

their bees. The plant blossoms June 20 to August 20, a good time and for a long season, were they valuable.

In the winter we cleaned the seeds. Although previously warned and consequently protected by veils and gloves, the barbed awns sought out our eyes and skin everywhere. The pain caused was intense. All who helped in the cleaning of the seed were in agony for several days. Even this alone would or should preclude this plant from general use. To my disappointment these plants seemed to exhaust themselves this first season. The next season there were almost no blossoms, but new plants came up very thickly from seeds scattered the previous autumn. This failure of the plants to afford blossoms the third season from planting I know is not always true, as I have had blossoms for four years from plants on sand. It is probable that when the plants are very luxuriant and are allowed to seed, we can only count on a single crop of blossoms. This season, the fourth from planting, we had a rather feeble growth of plants. The grass and weeds fought with the *Echinops* for the land and succeeded in so far that we secured a very meagre quantity of bloom, and apparently no valuable results in our honey crop. Thus the failure to bloom the first year, the failure to secrete any large amount of nectar, the failure in many cases to bloom the third year, and the inability to compete with grass and other weeds without expensive aid makes it certain that if any plants will pay for honey alone, this is not one of them.

THE ROCKY MOUNTAIN BEE PLANT.

This plant—*Cleome integrifolia*—has again been tried for the third year. That it is a very superior honey plant and blossoms at just the right time—all through July and August—is certainly true. But it is not a very pushing plant and the seeds will not germinate unless exposed to the weather for months. Thus it is necessary to plant in August or September of the previous year if we expect a fair stand of this plant. When this is done, unless the land is very free from grass and weed seed, the latter will get the start and our Cleome will be choked out. Thus I think we have proved that Cleome is only suitable for planting in waste places where, from its beauty and excellence as a honey plant, it rivals even sweet clover. There seems little doubt but that we should secure much honey from these plants were we to take the necessary pains to secure a full stand of acres of vigorous plants, but this can be done only at large expense, too large to ever pay in actual practice.

RAPE.

Knowing from the study of small plats which have been grown here for years, that rape, *Brassicæ campestris var. colza*, and the mustards seemed especially attractive to bees, and knowing that the former was regarded very highly by many farmers for pasture, especially for sheep, it was thought advisable this season to sow several acres of ground to this plant. Part of the land was light sand and part clay loam. As the plant blooms in about four weeks after the seed is sown, we sowed the middle of June. We are liable to have a severe drouth at this time, and this year was no exception. Thus the seed failed to germinate well especially on the sand. By the middle of July both fields were in full bloom. The bees did not swarm on the flowers as we had hoped they would, nor did the honey pro-

duct seem affected by the near presence of the rape. I am not sure that we gained any special advantage from the rape. If we did it was not perceptible. The weather for nearly all the time was very cool. I do not believe it will pay to sow rape specially for honey. If it is sown for pasture as recommended in England and Ontario, there will be but little bloom, and so, even in favorable years, the beekeeper would receive but small advantage. If grown for seed there would be a profusion of bloom, and in favorable seasons the honey product would be, without doubt, greatly augmented. It is certainly wise for the apiarist to encourage and even urge the planting in his neighborhood of any and every useful honey plant like rape, alsike, clover, buckwheat, etc. Often from unfavorable weather they will not afford nectar, but often they will bridge the whole distance between failure and success.

SWEET CLOVER.

Beekeepers have long known that sweet clover, *Melilotus alba*, though often failing to secrete nectar, is one of our first honey plants. It not only yields in favorable seasons very abundantly, but the honey from it is very white and excellent. This plant is known as Melilot, Sweet Clover, White Melilotus, and Bokhara Clover. While one or two authorities, Prof. THORNE of Ohio and Prof. TRACY of Mississippi, have stated that it possesses value as a forage plant, the consensus of opinion throughout the country is that this luxuriant plant possesses little value to feed either green or as hay. It has been sown in many parts of the country, by beekeepers and others, in waste places, along roadsides, etc., and in such locations has frequently added decidedly to the honey product. It is a beautiful plant with a very sweet perfume and may well replace rag-weed, May-weed, smart-weed, etc., along our highways. We sowed several acres to this plant this spring, six on sand and three on clay. The drouth came on and the catch on the sand was a total failure. On the clay it was only partially successful, but is spreading and we think will produce a fairly good crop. Our purpose is to see if it may not be a valuable silage crop. It surely produces abundantly. If it will be appetizing as silage so as to possess value to the farmer, then from its double value, as a silage plant and a most excellent honey plant, it may well be grown by the beekeeping farmer, and may be urged concientiously by the apiarist upon his neighbor farmer. This plant, like nearly all the clovers, is a biennial, and so we must wait until next year to complete our experiment, when we hope to prove that Melilotus is valuable for silage.

Our conclusions thus far are that special planting for honey will never pay. Unless we can find a plant that will always secrete nectar, and as seasons of honey failure occur in all countries, we conclude that no such exists, we certainly can not afford the expense and labor. I think our experiments warrant this conclusion. That it may, and often has, paid well to scatter seeds of sweet clover in waste places, there is no possible doubt. The first year's growth, and the second until after bloom, are very handsome. After bloom, the dry, ugly stocks may be cut, when the under growth from the seeds of the present season will make a pleasing border to the road. Cleome may also be planted in all waste places. This has been done with excellent results in Minnesota and Wisconsin. It is a very handsome plant, and like sweet clover is easily subdued if no longer wanted. In case this is desired, the seeds should be planted early in August and September, else they will not germinate well the following season.

BEES AS FERTILIZERS

Spraying fruit trees in early spring to prevent the ravages of various insects, is becoming very common. Spraying trees while in bloom is likely to poison the nectar and destroy the honey bee. This has been done in several cases. Not only have the mature bees been poisoned, but the brood has also been destroyed. The fact that doubt has been expressed in reference to such poisoning, and the fact that even legislatures have expressed disbelief in the value of bees to horticulturists, led to the following experiments.

Bees in cages were given foliage sprayed with sweetened water, and in other precisely similar cages, the same sweetened water in which London purple had been mixed in the proportion of one pound to two hundred gallons of water. The bees in the first cages were in no wise affected, while the others were all dead in thirty-six hours and in many cases in twenty-four hours. Thus we have positive proof, both in the field and from laboratory experiments, that bees are very susceptible to the poisonous effects of the arsenities, and that to spray fruit trees while in bloom always endangers the lives of all bees that visit the flowers. In the other experiments we desired to learn how important bees were in the work of fertilization and cross-fertilization of plants. Trees examined in May while in bloom showed twenty bees to one of other kinds of insect. On a rather cold day, such as is likely to occur in time of fruit bloom, hundreds of honey bees were found at work on the apple bloom, while almost no other insects were to be seen.

In the following experiments the same number of blossoms were counted on each of two adjacent branches on various trees, shrubs and plants. In each case one lot was marked by a tag giving the date of the experiment, while the other was surrounded by cheese-cloth just before the blossoms opened, thus precluding the visits of all insects from this lot except such very small insects as thrips, jassids, etc., which were so small that they would escape notice. After the blossoms withered the covers were removed, and two weeks later examination was made to note the results. The following table gives the results of the experiment:

Variety.	Date Covered.	Date Uncovered.	Number of Blossoms.	Date Examined.	Fruit Set.	Fruit set on Comparison.	
Apple	May 4	May 25	40	June 11	0	15	
"	" 4	" 19	75	" 11	0	3	
Crab Apple	" 4	" 19	200	" 11	0	3	
Apple	" 4	" 19	160	" 11	2	9	
Pear	" 4	" 19	140	" 11	0	7	
Cherry	" 4	" 19	300	" 11	9	119	
Strawberries	" 18	June 16	60	" 22	9	27	
"	" 18	" 16	212	" 22	80	104	
"	" 18	" 16	123	" 22	20	36	
Raspberries	" 26	July 6	2 canes.	July 6			Unsatisfactory.
"	" 30	" 6	184	" 6	93	160	
Clover (red)	June 12	" 30	10 heads.	" 30	0	191	
" (white)	" 5	" 30	"	" 30	0	541	

In the case of the strawberries, boxes covered with cheese-cloth were set over the plants. As these set on the ground, of course insects may have come up from the earth. Thus a few insects may have gained access to the flowers, as the plants were necessarily covered for about a month.

We see that in every case the fruit was greatly lessened, if we except one case of raspberries. In several cases, notably those of the clovers, no fruit or seeds were secured in the covered specimens. The strawberries seem less affected than any other of the plants, except the one case of raspberries. This may be owing, as suggested above, to the presence of insects, which come up from the earth beneath the plants Perhaps strawberries, when the blossoms contain both stamens and pistils, are less dependent on insects than many other fruits. The fact is very apparent that fruit-growers are nearly or quite as much interested in the presence of bees as are the beekeepers. Pomologists then may well join hands with the apiarists in demanding and securing a law making it a grave misdemeanor to spray fruit trees while they are in bloom.

EXPERIMENTS IN BREEDING.

That bees, like all other organisms, are greatly subject to variation, is known to every beekeeper. That they can be greatly improved by careful selection, is equally well understood by all observant queen-breeders. The mating habits of bees are such as to make experimentation in breeding difficult, but the obstacles are not insurmountable. We are working to overcome them and to develop a superior strain of bees, by judicious crossing and selection. This is slow work and we can hope for results only after long periods. Our stock is from Syrian and Carniolan and as the former predominates, we have this season bred very largely from Carniolan. Several of the most prolific queens are marked and it is the purpose to use the ones from these that winter the best the coming winter.

Besides the above, several other experiments of a miscellaneous character have been conducted, which are of more or less interest.

AMOUNT OF HONEY NECESSARY FOR WAX SECRETION.

This experiment was performed, that we might determine how much honey it requires to enable the bees to secrete one pound of wax. Three colonies were taken which we will designate as No. 1, No. 2, and No. 3, the bees of which weighed $6\frac{1}{4}$, $8\frac{1}{4}$, and $5\frac{1}{4}$ pounds respectively. No. 1 was given a virgin queen and no comb nor honey. No. 2 was given a virgin queen and empty combs. No. 3 was given a laying queen and empty combs. A vigorous colony on scales during the experiment gained $4\frac{1}{2}$ pounds. The bees did not fly from these hives as vigorously as from hives not in the experiment. The feeding doubtless had something to do with this. No. 3 seemed to gather more honey and to be in a more normal condition than Nos. 1 and 2. No. 3 had a full frame of brood ready to seal at the expiration of the experiment. Aug. 15, 28 per cent. of the bees in No. 1 had wax scales while none of No. 2 had them. In each case one hundred bees were examined. The experiment began August 11. The bees in each colony were fed twenty-one pounds of honey. The experiment lasted ten days.

	Col. No. 1.		No. 2.		No. 3.	
Weight of bees, Aug. 11		6¼		8¼		5¼
Total weight, Aug. 11, 7 p. m.	35		43		40¾	
" " " 22, 7 a. m.	46		62		61½	
Gain in weight in ten days	11		19		20¾	
Total feed given		21		21		21
Honey extracted Aug. 22		9		16½		18
Loss in honey fed		12		4½		3
Gain in weight in ten days		11		19		20¾
Wax secreted by No. 1	11¼ oz.					
Pollen in combs at close	½		1½		4*	
Total removed Aug. 22	10¼		18		22	
Error in work due to scales	¾		1		1¼	

* Brood and pollen.
7¾ lbs. honey consumed in secreting 11¼ oz. wax.

This experiment seems to prove that it takes eleven pounds of honey to secrete one pound of wax. Huber decided as the result of careful experimentation, upon twenty pounds as the amount, while Viallon and Hasty concluded that the amount was less than we have found in the above. Of course, in such experiments, there will be errors, as the colony is not kept in a normal condition. No brood-rearing can be allowed and so a virgin queen must be given to the colony. Whether the bees work with less vigor physically or physiologically when a laying queen is replaced by a virgin, I can not say. We thought over the experiment a long time and concluded on the above as the nearest approach to the normal of any plan we could decide upon. The results from colony number three, which was normal, show that the error was not great. A repetition will make the conclusion more surely correct.

DO WORKER BEES FEED THE DRONES?

Several times in the past we have tried experiments to determine whether the worker bees fed the drones, as they do the queen and larvæ, the albuminous portion of their food. We know that drones are great honey consumers. It is reasonable to suppose that they are equally great consumers of the albuminous food or bee-bread. There is little or no doubt that the upper head glands of the younger worker bees secrete the ferment that digests the pollen. These glands are large and turgid in the young or nurse bees; shrunken and inactive in old worker bees, and absent in the drones and queens. From anatomy, then, we would reason that the queen, drones, and older workers, the bees that do the outside work, as well as the larvæ, are fed the digested pollen, which is rich nitrogenous food. If this is true, and there can be no longer any doubt, then we have double reason to reduce the number of drones in the apiary, to save honey and pollen and also the energy of the nurse bees. To prove this point, we repeated the previous experiments of caging drones in the hive behind a single wire gauze, a double wire gauze, the space between being more than .26 of an inch, which is the maximum length of a worker's tongue, and a perforated zinc cage. Honey was placed in each cage, in such a way as not to daub any bees. In the first kind of cage the bees could reach the drones through the

single gauze, though at some inconvenience, so as to feed them the digested food. In the second case this would be impossible and the drones could only get honey for food. In the third case the drones were caged but could be and were freely visited by the workers, as the workers could pass freely through the perforated zinc, which the drones could not do. It will be seen that in the single wire cloth cage the drones were somewhat neglected. These experiments agree very closely with those previously tried.

The following table gives the results:

How Confined.	How Fed.	When Caged.	1 Day.	2 Days.	3 Days.	4 Days.	5 Days.	6 Days.	7 Days.
Single wire cloth	Honey	1 p. m.	2 dead.	1 dead	2 dead.	7 dead.	11 dead.	27 dead.	21 dead.
Double " "	"	"	8 "	16 "	21 "	all "			
" " "	"	"	7 "	20 "	24 "	24 "	24 dead.	all dead	
" " "	"	"	18 "	all "					
" " "	"	"	17 "	all "					
Perforated zinc admitting workers.	"	"	Lived for 15 days and would have lived indefinitely.						

THE HEAT CONDUCTIVITY OF WAX.

It is a common practice among beekeepers to confine the bees in winter to a portion of the hive thus to economize heat and the better to preserve the health and vigor of the bees. Some experiments in France seem to show that the combs are as good a protection as is a division-board, especially if fastened to close-fitting frames, or, as in nature, to the side of the hive. To test this matter we used a common division-board, a close-fitting empty comb, and a close-fitting comb full of honey. These were used successively to confine the bees to one part of the hive and leave a vacant space on the other side. A thermometer was suspended in this empty space and the temperature observed several times daily, and estimates made with reference to the outside temperature. The average showed no difference with respect to the division-board and the empty comb, but did show a slight difference in favor of the comb full of honey. We then used an empty hive, divided it into three equal compartments by use of a wooden and empty comb division-board, and again by the use of the wooden board and a full comb of honey, the combs being made as tight fitting as the wooden division-board. A small lamp was placed in the middle apartment and thermometers in the other two. The hive was set in the cellar where the thermometer marked a temperature of 58° F. The temperature in the compartment of the hive with the lamp was 110° F. In case of board and empty comb there was no difference in the temperature in the outer compartments, while with the comb of honey the temperature was 4½° F. cooler beyond the division, showing this to be a poorer conductor of heat and a better protection for the bees than either the board or empty combs. Thus we see that for winter protection, special division-boards are unnecessary if we but use close-fitting frames of comb, or make such frames close-fitting in the winter time. It is also apparent that combs full of honey are better as non-conductors than are empty frames. Thus in nature bees are well fortified against the cold of winter, as they are walled in on each side by several full combs which are fastened to the side of the receptacle. We also see that close-fitting frames or else frames with wide or close-fitting top and end bars

are better to protect the bees than are the common Langstroth frames. It is easy to see from the above why box hives and hives with close-fitting frames like the Heddon are well arranged to secure success in wintering.

CELLAR VS. OUTDOOR WINTERING.

In the more northern latitudes of the United States, bees winter better as a general thing, and consume less honey, in the cellar than on the summer stands, even though packed or kept in chaff hives. The last winter was an exception. Our bees in chaff hives wintered out of doors, consumed less honey apparently, and were in better condition in spring than were those wintered in the cellar. If we could be sure of such mild winters as the last two have been, cellars for wintering would certainly go out of use. Hence it is to be feared that many beekeepers will become confident, forgetting the cold and disastrous winters of the past, and soon there may come a return of the severe cold and the mortality among the bees will be as terribly disastrous as in the worst winters of the past. It is well to prepare for war even in times of peace. The wise beekeeper will arrange each autumn for a severe winter, then he will be safe in any event.

PACKING ABOUT THE HIVES IN SPRING.

We have proved for the past two or three springs prior to that of 1891, that to pack closely about the hives with excelsior or other poor conductor, confining the same by a large, well-covered case set around the hive, has paid exceedingly well for the expense of the case and the labor of adjusting it and the packing. The past spring we could see no such advantage. The unprotected colonies gained as rapidly and were as strong in May as were those in the hives that were protected. The explanation is not far to seek. The last spring was very mild, and bees suffered very little in any kind of hive. Usually we have many very cold, bleak days in April and early May. Then protection pays exceedingly well. The principle is a good one, "It pays to protect." Occasionally we have a spring like that of 1891, when it is unnecessary, but we should conduct our business for the general, not the exceptional.

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FRUIT NOTES.

Bulletin No. 81, March, 1892.

I.—STRAWBERRIES AND RASPBERRIES.

For various reasons this station is, better than any other, perhaps, able to carry on tests of the new varieties of fruits and vegetables. The originators are, each year, more and more appreciating the work of the stations in this line, and we have received from all parts of the country

seeds and plants that they may be tested before being placed on the market.

This bulletin contains the notes on some of the small fruits grown the past season in the gardens at the college. Many of the varieties have been under test for a series of years, and we only include such kinds as have been grown for at least two seasons.

The soil upon which they have been grown is a rather stiff, sandy loam, and, in the case of the strawberries, it has been well enriched with stable manure. The other fruits were supplied with sufficient plant food to make a good growth.

The soil and climate have much to do in determining the value of a variety, and sorts that do well in one section often are quite valueless in others. As the principal fruit belt of the state is along the east shore of lake Michigan, it was thought advisable to establish a fruit-testing sub-station in that region, in order that more reliable data might be furnished the fruitgrowers of that section, as to the value for planting of the new varieties that are being sent out each year. By carrying on the work at two points in the state we are able, by comparison of results, to draw more accurate conclusions as to the value of a variety.

The work at the sub-station in South Haven is in charge of Hon. T. T. Lyon, and the results of his observations have been published in Bulletins 55, 67, and 80, and in the reports of the State Board of Agriculture, and of the State Horticultural society for 1889, 1890, and 1891.

STRAWBERRIES.

The strawberries under test number about one hundred and fifty sorts, including a large number of unnamed seedlings sent here under numbers by the originators for trial. When they can be obtained the number of plants used for a test is twenty-four; but, very often, the originators only send a half dozen or sometimes a dozen, and this number is so small that we often have to spend a year in propagating them, before we have enough for a test.

The plants are kept one half in narrow rows, and the balance in hills, for a comparison of the two methods of cultivation. Late in the autumn, they were thoroughly mulched with straw and marsh hay, which was removed from over the plants as soon as growth commenced in the spring, but allowed to remain between the rows to keep down the weeds, and retain the moisture. The plants came through the winter without injury, and up to the middle of May promised a full crop of fruit, but, while in bloom, they were subjected to three severe frosts, which nearly destroyed the crop upon many of the varieties.

It so happened that, in several cases, the greatest injury was done to varieties that were considered the most hardy, and this seemed to be due to a characteristic of the plants that generally adds to their value. Varieties with stout flower stalks, bearing the blossoms above the leaves, as does the Crescent, were severely injured, while others with weak stems as are found in Haverland, were little injured, owing to the protection afforded by the foliage.

The effects of the frost were so uneven as to render the weighing of the crop on the different sorts, as an index of their productiveness, both useless and deceptive, and the statements here made, as to the yield of fruit, are, for the same reason, based in part on their behavior during the one or more years that they have been previously fruited.

The following table includes the more promising and best known of the kinds grown. The varieties planted in 1891 are omitted entirely, as are many of the new sorts sent here for trial that seem to have no value, or that are as yet in too small numbers to warrant an opinion.

STRAWBERRIES.

ABBREVIATIONS.

Form		Size.	Color.	
b. broad.	l. long.	s. small.	b. bright.	l. light.
c. conical.	o. ovate.	m. medium.	c. crimson.	r. red.
d. depressed	r. roundish	l. large	d. dark.	s. scarlet.
i. irregular.				

Variety.	Sex.	Vigor (1-10).	Date of bloom.	First ripe frui .	Last fruits.	Productiveness (1-10).	Size.	Form.	Color.	Quality.	Firmness.
Alpha	b	4	May 15	June 17	July 10	5	m	c	l c	8	9
Arlington	p	8	" 20	" 12	" 6	8.5	m	r c	b s	8	8
Beder Wood (*Racster*)	b	9	" 23	" 12	" 6	8.5	m	r	l s	7	8
Belle	b	8	" 25	" 25	" 8	9	m-l	l c	b s	8	9
Belmont	b	9.5	" 19	" 15	" 4	7	m to l	l o	b c	9.5	8
Bubach No. 5	p	9	" 26	" 15	" 8	9	l g	r c	d c	8	7
" " 132	b	7.5	" 23	" 15	" 1	8	m	l c	l s	7	7.5
Burt	b	8	" 22	" 15	" 6	8	m	r d c	d s	7	9
Charleston	b	7.5	" 26	" 22	" 6	6	s-m	c	b r	8	8
Clara (Florence)	b	9	" 23	" 22	" 6	8	m-l	b c	b c	8	8.5
Clinton	b	9	" 25	" 20	" 6	7	m	b c	d s	8	8
Crawford	b	9.8	" 26	" 16	" 6	7.5	l	r c	b s	9	9
Crescent	p	9.5	" 21	" 15	" 6	9	m	r c	b c	7	8
Crescent×Glendale	p	9	" 23	" 17	" 6	9	m	r c	b c	7	9
Cumberland	b	8.5	" 25	" 16	" 4	6	m	r c	l c	8	7
D. & D.	b	8.5	" 25	" 17	" 7	9	l	r c	d c	8	8
Daisy	b	9	" 27	" 16	" 5	8	m	r c	l s	8	8
Dew	b	9	" 25	" 23	" 9	5	lg	i	d c	7	9
Dubois	b	7	" 25	" 17	" 10	4	m	r	d r	8	8
Edgar Queen	p	8	" 25	" 15	" 6	7	s-m	i r c	s	5	9
Gandy	b	8	" 25	" 23	" 9	8	m to l	r b c	d c	8.5	8
Gen. Putnam	b	9.5	" 21	" 18	" 10	7	l	r	l s	8	7
Glendale	b	6	" 25	" 17	" 11	5	s-m	r c	d c	8	8
Gold	p	5	" 26	" 21	" 8	7	m	o c	s	8.5	7
Great American	b	8	" 25	" 23	" 6	6	l	b c	b r	8	8
Great Pacific	p	8	" 25	" 15	" 6	8	m-l	r c	b s	7	8
Hart's Minnesota	b	8.5	" 15	" 16	June 29	7	s to m	r b c	s	8	7
Haverland	p	9	" 26	" 14	July 8	9.5	m to lg	l c	b s	8.5	8.5
Howard No. 6	b	9	" 21	" 12	" 6	7	s	r	d c	9.5	7
Jessie	b	9.5	" 17	" 12	" 2	8	m to l	r b c	d c	7	7
Kearns	b	9.5	" 23	" 17	" 3	8.5	m	d c	d r	8.5	7
King No. 2	p b	9.5	" 25	" 22	" 10	8	m	r c	l c	8	7
Lady Rusk	p	9.8	" 23	" 20	" 15	6	m	r c	d c	7	8
Lida	b	8.5	" 16	" 16	" 4	9	m	r c	b c	7	8
Little No. 6	b	9.5	" 25	" 16	" 3	7	m to l	r c	d c	7	6
Little No. 24	b	7.5	" 23	" 23	" 6	7	m	l c	b s	6	6
Louise	b	8.5	" 26	" 22	" 6	8	m-l	o c	b c	7	9
Lovett's Early	b	8	" 19	" 12	" 6	8.5	m-l	r c	b c	8.5	8
Lower	b	8.5	" 18	" 16	" 6	7.5	m to l	r c	d s	8	8
Maggie	b	4	" 23	" 15	" 8	7	m-l	l c	b s	8	8
Mark	b	8.5	" 26	" 22	" 8	8	m	b c	b r	7	9
Maynard No. 20	p	4	" 23	" 12	" 5	4	s	c	c	7	7
Michel's	b	10	" 12	" 12	June 28	4	s	d c	b s	7	7
Miner's Prolific	b	9	" 25	" 17	July 10	8.5	m-l	c	d c	7	7
Moore's Early	b	8	" 17	" 16	June 29	5	s to m	b c	b s	8	8
Mrs. Cleveland	p	9.5	" 25	" 22	July 8	8	m-l	r b c	b s	8	8
Nigh's Superb	p	6	" 25	" 20	" 8	8.5	m	r b c	s	6	7
Oliver	b	9.8	" 18	" 23	" 10	5	m-l	r c	d c	6	10
Ontario	b	7	" 23	" 23	June 29	7	m	b c	d s	5	5
Parker Earle	b	9	" 25	" 15	July 6	7.5	m-l	b s	l c d	8	8

STRAWBERRIES.—CONTINUED.

Variety.	Sex.	Vigor (1–10).	Date of bloom.	First ripe fruits.	Last fruits.	Productiveness (1–10).	Size.	Form.	Color.	Quality.	Firmness.
Pearl	b	9	May 23	June 15	July 6	9.5	m to lg	r c	c	8	9
Pioneer	b	9.5	" 25	" 23	" 11	7	l	r c	d s	6	6
Porter's Seedling	b	7	" 29	" 19	" 11	5	s–m	r	c	7	7
Pride of Albany	b	7	" 25	" 20	" 9	7.5	m to l	r b c	d c	8	7
Prince of Berries	b	8	" 25	" 22	" 10	7	m	r c	c	9	8
Russell's Advance	p b	9	" 23	" 15	" 1	7.5	m	r	b s	7	9
Sadie	p	7.5	" 23	" 17	" 8	7.5	m	r c	d c	6	8
Saunders	b	9.5	" 26	" 20	" 6	8.5	m-l	l c	b s	7	8
Sharpless	b	8	" 23	" 26	" 4	8.5	l	b c	b c	8	6
Shaw	b	9	" 25	" 15	" 6	5	m	r b d	b c	9	8
Shuster's Gem	p	5	" 23	" 17	" 8	4	m	r i	d s	7	6
Stayman No. 1	p	6	" 26	" 20	" 6	8.5	m	r o	l s	7	6
Stimmel No. 15	p	8.5	" 25	" 22	" 8	8	m	b c	l s	8	8
Stimmel No. 20	p	9	" 23	" 16	" 3	7	m	l c	d c	9.5	8
Sucker State	b	9.5	" 22	" 15	" 4	8	m	r b c	l s	8	10
Summit	p	7	" 25	" 22	" 6	7.5	m to l	r c	d s	8	8
Tippecanoe	b	8.5	" 25	" 13	" 10	7.5	m	r	b s	9	8
Thompson No. 23	b	5	" 23	" 19	" 6	8	m	r c	c	8.5	8
Thompson No. 9	b	5	" 23	" 19	" 8	8	m	l o	d r	9	7.5
Thompson No. 12	p	5	" 23	" 22	" 10	8.5	m	b c	b s	8	6.5
Townsend No. 3	p	9.5	" 25	" 22	" 6	6	m-l	r d	d c	7	8
Townsend No. 19	p	9.5	" 25	" 22	" 6	8	m-l	r d	b s	8	8
Van Deman	b	8	" 25	" 13	" 6	8	l	r c	l c	8	8
Waldron	p	10	" 26	" 21	" 6	8	m	r c	b s	8	8
Walton	p	6	" 19	" 17	" 8	8	s-m	r	s	8	8
Warfield No. 2	p	9	" 23	" 15	" 9	8.5	m	r c	b c	8	7
Welch	b	6	" 23	" 20	" 6	5	m	r c	l c	8.5	7
Wilson	b	9	" 18	" 14	" 5	8.5	m to l	r c	d c	8	10
Woodruff No. 1	b	9	" 23	" 17	" 10	8	m	l c	d c	6	8
Woolverton	b	8	" 19	" 15	" 6	8	m-l	l c	d c	8	9
Yale	b	8	" 28	" 15	" 8	7	m	r c	d c	8.5	9.5

The notes given below are intended as brief descriptions of some of the more promising varieties, and as reports upon the behavior of many of the new sorts that have been sent here for trial.

Descriptions of many of the varieties grown and statements concerning them will be found in Bulletin 80, and where they do not differ from their appearance here, further mention will often be omitted.

Arlington, a vigorous and healthy variety. Seems to have no bad qualities, and in productiveness, firmness, and quality it is considerably above the average. A very promising early market variety.

Beder Wood a variety perhaps best known as Racster, but probably the first is the correct name. One of the most vigorous kinds grown, and although quite productive and worthy of trial, its behavior here does not warrant the high commendation given it by others.

Belle was received in 1889 from the Cleveland Nursery Co., now of Rio Vista, Va., as Thompson's 51. It is a strong-growing kind, and this year was one of our most promising of late kinds. The fruit is rather long, slightly necked, quite firm, of good quality, and fairly productive. It will be well worth trying.

Bubach No. 5, is now generally and favorably known as a vigorous, healthy variety, quite productive, and of fair quality and firmness, which agrees with our experence with it. The best of all varieties for local market, but rather soft for long shipment.

Burt is similar to Capt. Jack, in plant, but different in berry. A very hardy and fairly productive variety, but far below the claims made for it. It stands neglect better than most sorts and ships well.

Charleston made a small growth, and the berries are small in size and in quantity. Seems to be of no value.

Florence (Clara) is one of the most vigorous sorts grown, and the berries are of large size, fairly firm, and of good quality. It is also quite productive, and altogether is a promising sort.

Clinton was received for trial from Clinton, Iowa, and except in vigor of plant has no qualities that make it particularly valuable, as in productiveness, and in size, flavor, and firmness it is below the average.

Crescent × Glendale originated at Bradford, Vt., and was kindly furnished for trial by Matthew Crawford of Cuyahoga Falls, Ohio. It seems to have some of the characteristics of both parents. The plants are strong and healthy, and the fruit is much like Crescent, but larger, more firm, and comes a little later. From the few plants (12) grown, it seems as productive as Crescent, and a better shipping berry.

D. & D, is the name under which a variety has been advertised and sold by Mr. J. A. Dobbins of Barnesville, Ohio. The plant in some respects resembles Crescent, but in others is quite distinct; quite strong and free from rust. Many of the fruits have the shape so typical of Crescent, but are generally larger, darker in color, and perhaps slightly better in flavor. It also seems better adapted to hill culture than does that sort. From our test of twenty-five plants it seems fully as productive.

Daisy is another new variety that has some resemblance to Crescent. The plants seem quite healthy, and the berries are slightly larger and hold their size better. It has now been grown for three years, and in 1890 was one of our most productive varieties.

Dew originated in Lansing, and has been grown on a large scale by one or two parties. The plant is the strongest we have ever grown, and the foliage is almost perfect. Under the highest culture, and on heavy soil, the plants produce a goodly number of very large berries, some of them $7\frac{1}{2}$ inches in circumference, the larger ones being generally somewhat flattened. Berry quite firm and excellent for shipping, but it is not sufficiently productive to make it of value for general planting.

Dubois was received for trial in 1890 from M. D. Dubois, Newburg, N. Y. The first year the plants made an excellent growth, but were somewhat injured by rust; in 1891 they made a weak start in the spring, and, in general, were less satisfactory. The fruits were rather under the average in size, rather few in number, and fair in firmness and flavor.

Edgar Queen, plants fairly vigorous and productive. Fruit of medium size, very firm, somewhat irregular, and rather poor in quality. Too unproductive to be valuable, judging from our experience, but it would be a valuable shipping variety, should that quality develop.

Gandy, one of the older sorts that is only fairly productive, but is valuable on account of its lateness.

Gen. Putnam. Up to the middle of May, I considered it the most promising new sort in the collection. The plants were strong and healthy, the flower stalks were stout and bore a large number of blossoms. The frosts blasted our hopes with the blossoms; however, it was rather above the average in productiveness. It is rather deficient in firmness for shipping purposes, but will probably be valuable for local markets.

Great American, berries of large size, but it has no other characteris-

tics that even verge on the "Great;" plant rather weak; fruits few in number, generally irregular, and of fair flavor and firmness.

Great Pacific, plant vigorous and healthy, quite productive, berries of medium size, and of fair flavor, quite firm. While it does not begin to satisfy the extravagant claims made for it, it is rather above the average.

Haverland is one of the most promising varieties grown, and in five years has not failed to give good crops. As a medium early sort it has no equal.

Howard No. 6 is a vigorous spreading plant, but it has shown only fair productiveness and the berries are very small; flavor excellent. Another year's trial will be given it.

Jessie, which was so highly praised three years ago, is seldom mentioned now. It needs excellent soil and care. With us it has been quite above the average, however.

Kearns (Muskingum). Plants without name or number were received in 1889 from Grant Kearns, Zanesfield, Ohio, and were designated as above on our books. They were badly injured by frost in the spring, but still gave a fair crop. The berries are rather above the average in size, of good quality, and fairly firm. From their behavior in 1890, they seemed well worthy of trial as a late sort.

King, No. 2, received for trial from Edward King, Wooster, Ohio. Plants medium in size, vigorous and healthy. Quite late in ripening, fairly productive, quality medium. An average variety, but with no especially good properties.

King, No. 1, from the same source, is earlier and better in quality, but less productive.

Lady Rusk, received for trial in 1889. It seemed quite vigorous and fairly productive the first year, but has been less promising since. The plant and fruit bear a considerable resemblance to Crescent, and as the fruit is quite firm, the variety was highly commended by the originator as a market sort. Its productiveness is not high enough to make it valuable.

Lida, plant small in size but healthy and vigorous, setting more fruit than it will ripen, unless it has the best of care. Does best in hills, or in very narrow rows. With us it has been one of the most productive kinds grown, but it should only be planted on rich heavy soil where it can receive good care. For hill culture under these conditions it is one of the best varieties.

Louise is much less promising than in 1890. The plants seem lacking in hardiness and were only fairly productive.

Lovett's Early, as is claimed by its disseminator, is one of the very earliest kinds. The plant seems strong and free from fungus attacks; the fruit is medium to large in size, and considerably above the average in productiveness, flavor, and firmness. While it may not bear out its present promises, it certainly seems now to be a valuable acquisition.

Mark is a promising late sort, of very good quality, and quite firm. The plant is healthy and fairly productive.

Michel's Early, one of the strongest and most vigorous plants in the collection; a fair quantity of fruit was set and the first one or two pickings gave medium-size, light crimson berries, but they soon dwindled and fully half the crop was too small to pay for picking. In the appearance of the fruit and its fruiting habit, it is much like Crystal City, which some ten years since was urged on the public as an early market variety, but which was long ago discarded. In its favor, we may say that Michel's

Early will give about two fair pickings before Haverland and Crescent are ripe. Osceola is a name under which Michel's was sold by some parties.

Mrs. Cleveland is a very vigorous plant, and produces large, regular, and firm, round, conical berries. It has not shown itself sufficiently productive for a perfect market berry, but with a more favorable season it might go to the head; certainly promising.

Oliver has large, vigorous plants resembling Sharpless. The fruit is dark crimson, conical, regular, and very firm; fair flavor. Seems lacking in productiveness, which is all it needs to make it a valuable market variety.

Parker Earle, one of the best growing plants, but it makes few runners; up to the time of the frosts the prospect for fruit was excellent. The fruit is of a large size, long, conical, with a decided neck. Wherever this variety has been tried, good reports have been given.

Pearl, a vigorous plant, and for four years it has been one of the most productive sorts grown. Berries rather above medium in size, quite regular in form, and very firm. Unless grown in hills, the plants should be in narrow rows. A good sort for home use, and on account of its firmness excellent for market.

Porter, a fairly vigorous plant with stout, erect leaf stalks; berry rather small, round, crimson. From two years' trial, it seems so low in productiveness as to be valueless.

Pride of Albany, received for trial from D. W. H. Taylor, Brodhead, Wisconsin. Plants only medium in growth, hardy and healthy. Medium early with quite large berries of good quality. Seems valuable as a family variety, as it continues a long time in bearing.

Saunders, a very promising variety developed by John Little of Ontario, said to be a cross between Crescent and Sharpless, and its appearance would indicate it. Plants very strong; berries large, quite firm, and of good quality. The frost destroyed most of the crop in 1891, but in 1889 and 1890 it made an excellent showing. Well worth trying, particularly for market.

Shaw. This variety is much like Sharpless in plant, and its flower buds are even more tender than those of that variety, so that no fruit was obtained this year. Last year it gave a fair crop of medium-size berries of excellent quality and fairly firm.

Shuster's Gem. Most of the reports of this variety have been more or less favorable, but it has not proven satisfactory here, as the plants have not been vigorous. It is quite unproductive, and rather soft and poor in quality of fruit.

Stayman No. 1 is a vigorous plant; season medium; fruit rather small, produced in fair quantities, but not of high rank in quality or firmness. Seemingly of less value than the Crescent and other old sorts.

Stimmel No. 15. A promising seedling from John Stimmel, Paris, Ohio. Plants vigorous and quite productive; berries medium to large, of fair quality and firmness. No. 20, from the same source, is not quite so productive, but is of superior quality.

Thompson No. 23, from M. T. Thompson, Rio Vista, Va., is in plant and berry much like Crescent, but is bi-sexual and later in season, besides being of better flavor and perhaps somewhat firmer. Quite promising. Nos. 9 and 12, from the same source, seem less promising, but with longer trial may show some valuable qualities.

Townsend No. 19 is vigorous in plant, foliage healthy, fruit large, quite firm, very good in quality, and quite productive. Well worth planting as

a late variety, either for home use or market. As grown here it is more productive and a better shipping berry than Eureka, from the same source.

Van Deman, a vigorous bi-sexual sort from Arkansas. Plants quite vigorous and healthy; ripens with Wilson. Fruit large, regular, quite firm and of fair quality. Quite productive in 1890, but injured by frost last year. Well worthy of a trial.

Waldron was sent by Chas. Waldron of Ohio, and has now been grown for three years. Plants strong and healthy; season late. Fruits medium to large, regular, quite firm, and of good quality; above the average in productiveness. While it has shown itself less promising than some of the other sorts here it, as a rule, succeeds well on rich, rather heavy soils.

Walton, from C. B. Horner, Mt. Holly, N. J., is a medium-size, vigorous plant, and this year seemed to set more fruit than it could mature. As a consequence, the berries were rather small. Fair in productiveness, firmness and quality; season medium. Needs longer trial.

Warfield No. 2, is a very promising early sort, ripening with Crescent, which it surpasses in value, as it carries out the season better, and it is fully as large, and better in quality.

Woolverton was perhaps the best of Little's seedlings as tested here in 1890, but the frost reduced the crop in 1891. Fruit large, long, conical, with distinct shoulder. Quite firm and of good quality. Valuable.

Yale. Growth moderate, and plants make few runners. Productiveness fair, very firm and of excellent quality. Where sufficiently productive, it would be an excellent shipping variety.

SUMMARY.

Of the extra early sorts, Beder Wood, Lovett, and Van Deman are most promising, to be followed by Haverland, Pearl, Parker Earle, Bubach No. 5, D. & D., and Crescent×Glendale. As late sorts Belle, Florence, and Gandy succeed best here.

For home use, a selection can be made of the best flavored of the above sorts, that will furnish a supply of fruit through the season. The Belmont might be added on account of its superior quality.

RASPBERRIES.

The following tables show the behavior of a large part of the raspberries that have been under cultivation for more than three years. A considerable number of new sorts were planted in 1890 and 1891, but it is too early to judge accurately of their value. A brief note concerning some of the more promising sorts may be of interest.

Cromwell, a seedling from Connecticut, is in most respects similar to Souhegan, and has thus far seemed more healthy and somewhat more productive.

Lovett, which is also of the same class, is perhaps somewhat more spreading, and may take the place of Souhegan.

Of the red varieties, Royal Church, from Ohio, is one of the most promising sorts.

RASPBERRIES—Black and Hybrids.

ABBREVIATIONS.

Size.	Form.	Color.		Fungus (Anthracnose).
s. small.	r. round.	b. black.	g. glossy.	a. clear.
m. medium.	o. ovate.	p. purple.	l. light.	b. slightly affected.
l. large.	i. irregular.	y. yellow.	pu. pubescent.	c. badly affected.

Variety.	Vigor. Scale (1–10.)	Date bloom.	First ripe fruits.	Last fruits.	Productiveness (scale (1–10.)	Size.	Form.	Color.	Quality.	Fungus.	Per c't of blossoms injured by frost.
Acme	8.5	June 10	July 7	July 21	6	m	r	b	9	a	0.
Ada	7	" 11	" 11	" 30	8	m	r	g b	8	c	0.
Carman	4	" 3	" 1	" 31	7	m	r	g b	9	c	60.
Caroline	6	" 3	" 6	" 31	9	m	r	l o	8	c	40.
Centennial	5	" 3	" 5	" 22	9.5	m	r	g b	7	b	1.
Doolittle	8	" 1	June 29	" 20	9	m	r	g b	7	b	3.
Davison's Thornless	5	" 3	" 29	" 21	6	s m	r	b pu	9.5	c	10.
Gregg	8	" 10	July 7	" 31	8	l	r	b pu	6	c	0.
Hopkins	7.5	" 3	" 1	" 22	8	m	r	b pu	7	b	4.
Hilborn	8.5	" 3	" 5	" 20	8	m l	r	b	9	b c	0.
Kellogg	6	" 2	" 5	" 24	9.5	m	r	b pu	8	b	20.
Ker's Seedling White	7	" 2	" 1	" 28	7	l	r	l y pu	8	c	8.
Mammoth Cluster	8	" 8	" 5	" 23	9.5	m	r	b pu	8	c	2.
Nemaha	8.5	" 1	" 9	" 23	9	l	r	b pu	6	b	5.
Ohio	9.5	" 3	" 6	" 26	10	l	r	b	6	c	4.
Pride of the West	7	" 3	June 29	" 19	6	m l	r o	b g	6	c	5.
Shaffer	7	" 13	July 8	" 31	9.5	l	r o	p pu	9	c c	0.
Souhegan	7.5	" 2	June 27	" 20	9.5	m	r	b	8	c	0.
Sweet Home	7	" 4	July 6	" 31	7	m	r	g b	7	b	3.
Tyler	8	" 1	June 29	" 18	9	m	r	b	8	b	3.

From the table it will be seen that Souhegan, Tyler, and Doolittle still stand at the head of the list of the early black caps; Hopkins follows in a few days. Of the later kinds Gregg and Nemaha are among the best. Centennial, Kellogg, and Mammoth Cluster are smaller berries. but the plants are hardy and productive; Ohio is particularly valuable for evaporating and will grow in many localities where other kinds fail. Shaffer is a strong grower, very prolific, and the large, showy fruits are excellent for preserving. The color is not particularly attractive, and the flavor is peculiar; a demand for it can soon be secured, and it should be very largely planted. For home use a few plants of Caroline will be useful.

RASPBERRIES—Red.

ABBREVIATIONS.

Size.	Form.	Color.		Fungus (Anthracnose).
s. small.	r. round.	d. dark.	o. orange.	a. free.
m. medium.	c. conical.	r. red.	b. bright.	b. slightly affected.
l. large.	o. ovate.	p. purple.		c. badly affected.

Variety.	Vigor. Scale (1-10).	Date bloom.	First ripe fruits.	Last fruits.	Productiveness. Scale (1-10).	Size.	Form.	Color.	Quality.	Fungus.	Per ct. of blossoms injured by frost.
Amazon	6	June 9	July 9	July 24	9	s m	r c	d r	9	a	0.
Brandywine	7.5	" 11	June 29	" 22	8	m	r c	d r	8	b	0.
Brinkle	4	" 8	" 29	" 20	2	l	r c	o	10	c c	0.
Burlington	7	" 12	July 8	" 21	4	l	r c	r	9	c	5.
Canada	7	" 12	" 6	" 23	6	m	r o	r	9	b	9.
Catawissa	7.5	" 12	June 30	" 22	9	m	r o	r	8	b	0.
Crimson Beauty	6	" 3	" 28	" 20	9	s	r	d r	7	c	6
Cuthbert	9	" 12	July 7	" 31	9	l	r c	r	8	b	0.
Diadem	2	" 13	" 6	" 23	5	l	o	r	9	b	0.
Heebner	7	" 10	June 29	" 20	9	l	r c	r	9	b	0.
Herstine	5	" 11	July 7	" 25	8	m	r	b r	9.5	c	0.
Highland Hardy	8	" 1	June 30	" 22	6	l	r c	r	7	b	8
Henrietta	5	" 3	" 29	" 21	8	m	r	r	8	b	2
Lost Rubies	8	" 3	June 29	" 23	6	s-m	r	d c	8	b c	1.
Marlboro	6	" 8	July 7	" 24	6	m	r	r	7	c	0.
Michigan Early	9	" 1	June 23	" 21	10	s	r	r	9.5	b	0.
Miller's Woodland	8	" 11	" 29	" 30	10	m	r	r	8	b	0.
Montclair	8	" 8	" 29	" 31	9	m	r c	r	7	b	10.
Niagara	5	" 10	July 8	" 25	9	m-l	r o	r	9	c	2
Parnell	4	" 1	June 28	" 22	8	l	r o	r	9.5	c	0.
Philadelphia	6	" 9	July 6	" 21	8	m	r	d p r	6	b c	1
Queen	8	" 10	June 29	" 22	5	m	o	r	9.5	b	0.
Reliance	7	" 2	" 27	" 21	7.5	l	r	d r	6	a b	4.
Reder	5	" 3	" 20	" 23	5	m	r	r	9	c	0.
Red Cluster	7	" 10	" 30	" 21	7	m	r c	r	9	b	0.
Scarlet Gem	7	" 5	" 29	" 23	5	m-l	r	b r	5	c	2.
Surprise	7.5	" 10	" 29	" 23	6	l	r c	d r	6	b	2.
Talcott	5	" 1	" 28	" 20	9	m	o	r	9.5	c	60.
Thwack	5	" 9	July 7	" 23	4	m	r	p r	9	c	1.
Turner	9	" 8	" 7	" 22	5	m-l	r c	r	9	b	1.
Welch	7.5	" 1	June 27	" 22	9	m-l	r o	r	9	b	1.

Of this comparatively long list of varieties not more than three or four are really valuable here.

Michigan Early and Hansell, which in plant and fruit have many points in common, are among the best early red varieties; Cuthbert, although slightly tender here, is our best sort for the main crop; Marlboro in some places is an excellent market variety, but it does not prove profitable here; on account of their hardiness, Turner and Thwack seem suited to cultivation in sections unfavorable to fruit; Golden Queen is much like Cuthbert except in the color of the fruit, and would be valuable for home use.

II.—MISCELLANEOUS FRUIT NOTES.

In addition to what is being done in the way of testing fruits here and at South Haven, we also have under trial in more than fifty places in the state, smaller collections of fruits both large and small, that should also be of much value to us.

RUSSIAN FRUITS.

In the northern counties, away from the lakes, the ordinary varieties of apple have not been found sufficiently hardy, and in order to test the value of Russian fruits in these regions, over fifty varieties of apple, besides smaller numbers of pears, cherries, and plums have been planted. The principal orchard is at Grayling, Crawford county, and contains over 300 trees, of varieties especially selected for their hardiness. Some of these trees have now been planted three years, and I have yet to learn of any injury from winter killing, while the results in the same sections with ordinary nursery trees have been quite disastrous.

Most of the varieties have been fruited in Iowa by Prof. J. L. Budd and others, and are said to compare favorably in productiveness, size, and quality with our best varieties.

Most of the kinds are from eastern Russia, and western Siberia, where they succeed admirably on the dry, sandy plains, and in a climate far more severe than they will need to undergo in Michigan.

THE STATION ORCHARDS.

The collection of fruits, both large and small, is quite complete, and it is proposed each year to add such new varieties as are deemed worthy.

Of the apple we now have about 350 varieties in the station orchard; of these some 50 kinds are in bearing, and the others have been planted from one to seven years, mostly in 1890.

The pears number 75 varieties, 40 of which have borne fruit. There are sixty sorts of plum, including all the leading European, Japanese, American, and Chickasaw varieties; the cherries number 50 varieties, and the peaches about 60; besides apricots, quinces, etc.

CARE OF ORCHARDS.

The orchards are for the most part kept in cultivation, those of bearing age being without crops. The cost of this cultivation is very slight, as we go over the ground once in ten days or two weeks, from May 1, to August 15, with an Acme harrow or Pearce orchard cultivator; the soil is thus stirred to a depth of two or three inches, and acts as a mulch to conserve the moisture, while the frequent cultivation gives the weeds no chance to start.

As an experiment, some ten rows in the old apple orchard have been kept in sod for two years, and the effect has been very marked, both in the growth of the trees and the appearance of the foliage. It is yet too early to see what effect it will have on the number and size of the fruits.

FERTILIZERS FOR ORCHARDS.

As a fertilizer we have made use of unleached wood ashes. On most soils no other fertilizer need be used for a number of years, but on light or exhausted soils the application of perhaps twenty loads of decomposed stable manure, or, if this can not be obtained, of fifty pounds nitrate of soda and two hundred pounds of fine ground bone per acre, which, with one hundred bushels of ashes, will make a complete fertilizer. In case the

fresh ashes can not be obtained, two or three times the quantity mentioned of leached ashes would have a marked effect. Wood ashes have a tendency to solidify and compact the soil, hence they are excellent on light land, but care should be taken not to use them to excess on heavy soils.

Coal ashes have a similar effect on the physical condition of sandy soils, and may be used for this purpose, but they *do not* furnish any food for plants, that is of value.

For young trees, the quantities mentioned are much too large, unless the fertilizers are to be applied broadcast for other crops, but, in old bearing orchards, the amounts can often be increased with profit, and they should be spread over the entire soil, as the feeding roots of the plants are, for the most part, outside a circle ten feet in diameter drawn around the tree.

Where potash is needed in the soil, as is frequently the case with bearing orchards, and wood ashes can not be obtained, it can be secured as muriate or sulphate of potash. These are waste materials from German salt mines, and sell at about $40.00 per ton for the muriate and $25.00 for the latter, the price varying with the amount of potash they contain. It is from these salts that the manufacturers of the high-grade commercial fertilizers obtain their potash.

Two hundred pounds of muriate of potash will supply an abundance of potash for a bearing orchard, if the soil is moderately rich, while a much smaller quantity will generally have a very marked effect on young trees. The other materials most likely to be needed by trees, and in fact by all crops, are nitrogen and phosphorus, and in case stable manure is not readily obtainable to supply them, recourse can often be had with profit, to chemical fertilizers. As a rule, the best source for nitrogen is in the form of nitrate of soda or, as it is commonly called, Chili saltpetre. This costs from $45.00 to $50.00 per ton at the sea-board, and, as not over 100 pounds per acre are usually required, the expense is not great. Among the other materials rich in nitrogen, are sulphate of ammonia, a waste product of gas houses, and dried blood, etc., from slaughter houses.

As a source of phosphoric acid, fine ground bone is largely used, although dissolved bone black will give quicker effects.

From 200 to 400 pounds of these materials per acre should be enough.

As a formula for mixing the above materials, for an acre of apples or other fruits, we would then have

50 to 100 pounds nitrate of soda.
100 to 200 pounds muriate of potash.
200 to 400 pounds ground bone.

If 50 to 100 bushels of unleached wood ashes could be obtained, they would more than take the place of the potash, and would supply perhaps one half of the phosphoric acid required.

Before using any chemical fertilizers to any extent, it is well to test the effect of each of the above materials on separate plats, in order to learn if they have any effect. Oftentimes one or more of them will be found to be present in sufficiently large quantities, and if more was applied it would only be wasted.

The soluble chemicals should only be applied in the spring, or, better yet, after growth has commenced; they should generally be scattered

broadcast, and harrowed or dragged, rather than plowed in. Precautions should be taken not to bring these chemical fertilizers into contact with the roots of trees, as the results might be disastrous.

L. R. TAFT.

AGRICULTURAL COLLEGE, MICH., *March 1, 1892.*

INSECTICIDES AND FUNGICIDES.

Bulletin No. 83; April, 1892.

While many of our largest and most successful fruitgrowers make free use of insecticides and fungicides, in protecting their plants from destruction by animal or vegetable parasites, in many sections of the state little attention has been paid to their use, and but slight knowledge is possessed concerning them.

Inquiries are so frequent, as to the best preparations to use, and the methods of applying them, that this bulletin has been prepared in the hope that it will furnish the ordinary farmer with such information as will enable him to meet his enemies and conquer them.

The statements concerning the habits of the insects and the characteristics of the fungi, are well known to many persons, but are new to others, and are here given, as a knowledge of them is necessary to a rational system of fighting them.

Instead of giving the results of our experiments with insecticides and fungicides, in the usual bulletin form, with tables, diagrams, etc., we shall attempt to state our conclusions in a manner that may, perhaps, be fully as clear.

Most of the formulas recommended for the destruction of both insects and diseases, have been thoroughly tried here, and the others have been used with success by persons in whom we have the utmost confidence.

INSECTICIDES.

It is now some fifteen years since the arsenites began to be commonly used for the destruction of injurious insects. The Colorado potato beetle was about the first for which they were recommended, but so much has been learned of the habits of insects, and of the best methods of fighting them, that we now know that a large per cent.—perhaps more than half—of our injurious insects can be destroyed by their use.

So far as the kind of insecticide to be used is concerned, we may group the insects into two classes, (1) those that *eat* their food, and (2) those that have special organs by which it is sucked up. The arsenites will have no effect upon the insects of the second group, but, with very few exceptions, they can be used with certainty against those in the first, provided they can be distributed so that the insects will take them in with their food.

PARIS GREEN AND LONDON PURPLE.

The two forms most commonly used are, Paris green or arsenite of copper, and London purple or arsenite of lime; the latter is light, and is easily suspended in water, requiring much less attention in stirring than Paris green to keep it from settling, and on the other hand it is more readily soluble in water, and is more likely to burn tender foliage. The reverse of this, however, is true when combined with ammonia containing fungicides.

For all large trees, they are used in water at the rate of one pound to from 200 to 300 gallons, but, for some of the vegetables and small fruits, it is perhaps preferable to use them as a powder, at the rate of one pound to from thirty to one hundred pounds of plaster, or flour.

For the apple, and, in fact, for all of the fruits and vegetables with thick, rough leaves, the use of one pound to 200 gallons of water is none too much; but for the peach and similar trees, it should never be over one pound of the poison to 300 or 350 gallons of water, and, after the first of July, even this will be found too strong.

In addition to the potato beetle mentioned above, the arsenites are used largely as remedies for the codlin moth, plum curculio, cherry slug, currant worm, and hundreds of other leaf-eating insects.

Whether applied as a powder, or in water, an attempt should be made to reach, with the poison, every part of the plant, and for this reason a bellows or pump, that throws a fine powder or spray with considerable force, is desirable. In the use of liquids, the spraying should be kept up until every part has been touched and the plant begins to drip, and it should then be discontinued. The same rule applies to other insecticides and to all fungicides.

INSECTICIDES FOR SUCKING INSECTS.

In addition to the large class of insects that obtain their food by means of jaws, there is another that has its mouth parts modified into a tube, through which it sucks the juices of plants and animals. Such insects can not be poisoned by arsenites, and some insecticide must be used that will kill by contact. The simplest and best is known as

KEROSENE EMULSION.

The formula recommended by Prof. Cook has proven very satisfactory, and is as follows: Dissolve $\frac{1}{4}$ pound of hard soap in two quarts of boiling water, add 1 pint of kerosene and mix thoroughly. This should form a thick, cream-like mass. Before using, it should be diluted to two gallons, with water, for most plants. For plants with tender foliage, like the squash, this will prove too strong, and in such cases, various strengths should be tried, until one is found that will not injure the plant, and yet be

strong enough to kill the insects. This remedy is recommended for the apple aphis, bark lice, scale, and all similar insects.

PYRETHRUM OR BUHACK.

In some cases, it is not practicable to apply either arsenites or kerosene emulsion, as on cabbages for the cabbage worm. For such insects, the the insect powder known as pyrethrum or buhack, may be used, either in a dry form, or with water at the rate of a heaping teaspoonful to the gallon. This remedy, like kerosene emulsion, kills by contact, and, as its effects are not lasting, should be repeated if other insects appear on the plants.

CARBOLIZED PLASTER.

For the plum curculio, the carbolized plaster has been used with success, but, as the arsenites prove fully as effectual, and are easier to apply, its use has not become very common. Where one has no spraying outfit, and only a few trees, the remedy is a valuable one.

The insecticide is prepared by mixing one pint of carbolic acid with 50 lbs. of land plaster. This can be thrown over small trees, while the dew is on, at the time the blossoms fall and at intervals of ten days or two weeks for a month thereafter.

TREE WASHES.

For washing the trunks of trees to repel the attacks of borers, and to destroy such insects as may be upon them, the carbolic acid and kerosene emulsion is excellent. The kerosene emulsion is made exactly as for any other purpose, except that one quart of soft soap should be substituted for the hard soap, and, without the final dilution, one pint of crude carbolic acid of good strength should be added.

When scale insects are on the larger branches, they can be easily destroyed by this wash. The emulsion will consist of one quart soft soap, 1 pint kerosene, and 2 quarts water, to which 1 pint of carbolic acid is added.

Other tree washes contain, instead of kerosene, lime, sulphur, or arsenites, but they are less reliable than the one given above. Where borers are troublesome, however, the addition of a small amount of Paris green to the kerosene wash will render it more lasting in its effects.

We append brief descriptions of some of the more

INJURIOUS INSECTS.

In order to so apply our remedies as to produce the best results, some knowledge of the habits and characteristics of our enemies should be possessed, and to afford a slight insight into the structure and methods of securing their food, we give short notes concerning a few of the more common of our injurious insects, selecting those that readily yield to treatment.

CODLIN MOTH.

This insect, more commonly known as the apple worm, has for many

years proved more injurious to the apple than any other. The perfect insect is a moth with a wing-spread of three fourths of an inch. They appear while the apple is in bloom and, soon after the petals fall, deposit an egg in the basin of the calyx. The larva hatches in six or eight days and eats its way into the core. After three or four weeks, it attains full size and makes a burrow from the core to one side of the apple. If the little apple has not already dropped to the ground, the worm lets itself down by a silken thread that it spins, or crawls down the trunk. It seeks some hiding place, and develops into a pupa, from which it comes forth, at the end of three weeks, a moth. A second batch of eggs is laid, and the worms from this brood are many of them gathered in the winter apples. Emerging from these, they change to pupæ and appear as moths the following May. At the south, a third brood may be developed.

Various remedies have been tried, such as trapping the moths with lights and pans of water, and destroying the pupæ that may be in bands of cloth or straw fastened around the trunks of the trees, but none have proven efficient. The cheapest and surest method is to spray the trees, as soon as the blossoms have all fallen, with water containing London purple at the rate of one pound to two hundred gallons. If the worms are very numerous, it will pay to make a second application at the end of five weeks.

If the neighboring orchards have not been sprayed, or if the season was rainy for the two weeks following the first spraying, a second application should always be made.

TENT CATERPILLAR AND CANKER WORM.

These, with other spring leaf-eating insects can be destroyed with the arsenites and, as a rule, the application for the apple worm will destroy all of this class.

In case there is no crop to necessitate spraying for the codlin moth, the "tents" of the caterpillar can be readily seen, and can be readily rubbed off with the hand or with a swab at the end of a pole. As the worms are usually "at home" early in the forenoon, and toward sunset, they can easily be destroyed, if the work is done at that time.

PLUM CURCULIO.

The "Little Turk," as he is called, is so destructive to plums and, in a measure, to cherries, peaches, and apples, that few fruits escape him if he is unmolested.

The jarring process has been used with success for years, but is tedious and expensive. For some ten years, spraying with arsenites has been experimented with, and, although it is impossible to save all the fruits by this method, persistent efforts will save the bulk of the crop.

The mature insects are minute dark brown beetles, with a large snout. They appear about the time the plums bloom—in some seasons they have been noticed before the flowers open—and, as they feed on the foliage, the poison destroys them. In depositing their egg, they first make a cavity and, after placing the egg in this, cut a semi-circular canal around it. This crescent-shape cut is a sure sign of the work of the "Turk."

In some seasons, he appears before the flowers open, and as it is not advisable to spray while the trees are in bloom, on account of the injury it would do to the bees, an application made just before that time would be

likely to destroy all the curculio that appeared during the period of bloom. In case rains wash off the poison, it should be reapplied.

CURRANT WORMS.

The usual remedy for the larvæ that feed on the leaves of currants, is hellebore, applied either dry or in water, but, as frequent applications are necessary, we have come to rely on the arsenites. If applied in a thorough manner, as soon as the eggs of the first brood begin to hatch, no other treatment will be necessary, and, as the fruit is at that time very small, no danger of poisoning it need be feared. For applications later in the season, if they become necessary, hellebore in water, at the rate of a teaspoonful to the gallon, will be safer, although a weak mixture of Paris green applied in *a fine spray* would do no harm.

COLORADO POTATO BEETLE.

The arsenites have come so commonly into use, for the destruction of this insect, that the only mention necessary here is to say that, when thoroughly mixed, the amount required of the Paris green is much less than is commonly used. When applied with plaster, one part to one hundred, or even one part to two hundred parts of plaster, will answer very well, if the mixing is thoroughly done. When one has a knapsack pump, application in water, covering two rows at a time, will be fully as satisfactory.

CHERRY AND PEAR SLUG.

This slimy, brown slug eats the soft part from the leaves of cherry and pear trees, appearing during the early summer. Their advent should be watched for, and remedies should be immediately applied. Dry dust, coal or wood ashes, plaster or air-slaked lime thrown over the trees, will destroy them, but, if the trees are large and numerous, the arsenites can be more readily applied, and are rather more effectual.

The above are among the insects that are most troublesome, and the arsenites can be relied on to destroy them, and they will at the same time kill such other insects as may be eating the foliage of the trees, or plants to which they are applied.

FUNGICIDES.

Nearly all of our plants have from one to a dozen parasitic fungi, that feed on their substance, and, if they do not destroy the plants themselves, greatly lessen the value of the crops produced by them.

The fungi themselves are plants of a very low order, and develop rapidly from spores (seeds), when exposed to proper conditions of heat and moisture. In some cases, they penetrate the substance of the plant and destroy its cell structure; after a while, when they have finished their growth, they burst out through the epidermis, and develop a mass of slender stalks, on which the spores are produced. These, as a rule, are minute spherical or elliptical bodies, generally colorless, orange, or black and may at once germinate, giving rise to a new fungus, or may survive until the following spring.

A few forms, such as the powdery mildews, live on the outside of their hosts, and secure their food by sending slender root-like organs down into the tissues. Such plants are readily destroyed by almost any fungicide. Most of the fungi, however, live within the plant, and, if they have once gained a lodgment, can then carry on their work of destruction, and will be beyond the reach of any fungicide. For all such, the applications must be made early in the season, before the spores have germinated, and should be repeated at frequent intervals.

FORMULÆ FOR FUNGICIDES.

The following standard formulæ have been thoroughly tested both in this country and in Europe and, when used in season, have been found effective remedies for the diseases for which they are recommended.

BORDEAUX MIXTURE.

This when used as in formula 3 is one of the cheapest and perhaps most powerful fungicides in the list. It remains on the plants a long time, and as it looks something like whitewash, should not be applied to parts that are to be used as food. This, although it adds to its value as a fungus destroyer, greatly lessens the range of plants upon which it can be used.

Three formulæ are given below, differing only in strength, which should be used as described later on.

1. Dissolve 6 pounds of copper sulphate in 16 gallons of hot water. Slake 4 pounds of quick-lime in 6 gallons of water. When cool pour together slowly, with constant stirring. This may be modified by using 8 pounds of lime and after slaking allow the lime to settle, using only the lime water.

2. Use 4 pounds copper sulphate, 3 pounds of lime, and 22 gallons of water; or

3. Two pounds copper sulphate, 1½ pounds of lime, and 22 gallons of water.

The greatest care should be taken to strain the mixture as otherwise the valves of the pump and the nozzle will become clogged, and considerable time will be wasted in cleaning them. For this fungicide, in particular, the Vermorel nozzle should be used, as it is so readily freed from obstructions.

EAU CELESTE.

The original formula for this fungicide did not prove entirely satisfactory, on account of the injurious effects that were often produced on the foliage; for this reason a modified formula was recommended and has been found much more desirable. As we have used it, the following proportions have been found satisfactory:

Sulphate of copper	2 pounds.
Carbonate of soda	2 pounds.
Ammonia water, 26°	3 pints.
Water	32 gallons.

Dissolve the copper sulphate in 2 gallons of hot water; in another ves-

sel dissolve the carbonate of soda (sal-soda), pour together and mix thoroughly; when all action has ceased, add the ammonia water, and before using dilute with the remainder of the water.

AMMONIA SOLUTION OF COPPER CARBONATE.

Copper carbonate can be obtained as a dry powder, and is prepared for use as a fungicide, as follows: Dissolve 3 ozs. of copper carbonate in one quart of ammonia water (26°), and dilute to 32 gallons. If copper carbonate can not be readily obtained, the formula given as modified eau celeste can be used instead, and will be found considerably cheaper. A commercial ammoniacal carbonate of copper is known as liquid copperdine. A mixture that will be practically the same, on solution, can be made by mixing one half pound of powdered copper sulphate and one pound of carbonate of ammonia. This can also be purchased pulverized and mixed, ready for use by merely adding 32 gallons of water.

The commercial name of this mixture is dry copperdine.

Of the various copper mixtures, none have proven more satisfactory than the above, which was first recommended by Prof. S. W. Johnson, director of the Connecticut experiment station.* It is also cheaper than any except the Bordeaux mixture, and although the latter is fully as effectual as a remedy, is not likely to clog the pump or nozzle, or to spot the clothing of the operator, and disfigure the fruit, which is so serious a fault in that remedy.

Commercial carbonate of copper suspended in water has been tried, but is hardly satisfactory; however, if the precipitate formed in making modified eau celeste is used without being dissolved in ammonia, it will be found quite satisfactory, if applied at once.

POTASSIUM SULPHIDE.

For some diseases, such as the gooseberry and other powdery mildews, a solution of sulphide or sulphuret of potassium (commonly known as "liver of sulphur") is an excellent remedy. The usual formula is one ounce to three gallons, and for diseases of the above class it is a cheap and effective remedy, and is particularly desirable in case of the gooseberry mildew, as it does not discolor the fruit, as would the copper compounds.

DISEASES OF THE GRAPE.

Few, if any, of our cultivated plants are attacked by more fungous diseases, or are more injured by them, than is the grape. It seems as if, whatever be the nature of the season, there is some destructive grape disease for whose development it is especially adapted.

Probably the best known and, in the past, the most destructive diseases of the grape are the *mildews*. These are of two kinds, and are commonly known as the downy and the powdery forms.

The *downy mildew* (Fig. 1.) works in the interior of the leaves, and gives the upper side a yellowish appearance; in a short time the spores are produced on the extremity of minute threadlike stems, that protrude through the stomata on the under side of the leaves, and look like downy or frosty patches. The spores soon drop off, and, if they fall on a moist

* Connecticut Experiment Station Report, 1890.

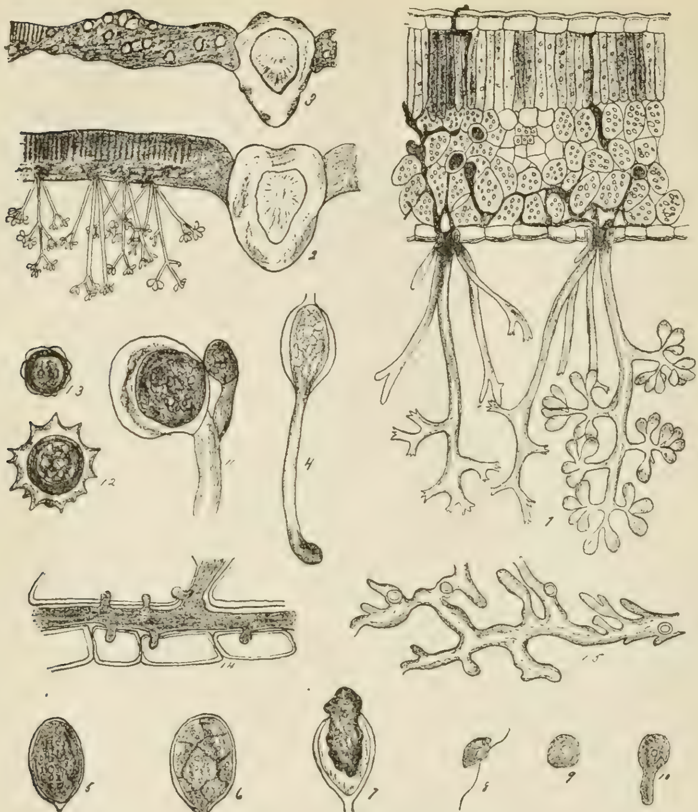

FIG. 1.—DOWNY MILDEW OF THE GRAPE. *Peronospora viticola.*

1. Section of leaf (greatly magnified) showing conidial stage.
2. Showing the same, less magnified.
3. The same, showing the effect of the fungus, the leaf brown and shrivelled.
4. Germinating conidia.
5-8. Development of conidia through zoöspore and swarm-spore stages.
9. Spore.
10. Germinating spore.
11-13. Fertilization of oogonium and development of the oospore.
14. Section of leaf greatly magnified, showing mycelial thread passing *between* the cells, and sending its haustoria into them.
15. Branching mycelium, the spots representing haustoria. —*After Viala.*

place, germinate with great rapidity. The contents swell, become segmented, and finally burst forth as ciliated swarm-spores. They move about for a time, and then, having come to rest, drop off their cilia and soon throw out a mycelial thread which develops into a new fungus, if the conditions are favorable. In this way, the downy mildews rapidly reproduce themselves during the summer, generation following generation in quick succession. As winter approaches, the fungus sets about the development of spores with thick coverings, that will enable them to withstand the winter's extremes. These are developed at points where two threads cross or come in contact. Each thread gives rise to a rounded protuberance, one corresponding to the pistil, and the other to the anther of flowering plants. The contents of one pass into the other, and the development of the oogonium commences. It finally becomes covered

with a thick cell wall, and at the proper time in the spring germinates, either by at once sending out a germ tube, or segmenting and then pouring out its contents as ciliated zoospores, much like those developed from the conidia. The tender shoots and berries are also attacked by this fungus. The disease is particularly favored in its development by cold, wet weather, although any weakness of the vines caused by overbearing, soil exhaustion, or similar causes, may both induce the development of the disease and increase its injurious effects.

In many respects the *powdery mildew* is quite the reverse of the downy form. It flourishes in hot, dry weather; it is not found within the tissues, but forms powdery masses on the outside, obtaining its food by means of short suckers with which it pierces the epidermis. Under favorable conditions, the fungi wax and grow strong, and at length send up fruiting hyphæ (Fig. 2, [1]) on which the summer spores are produced by constriction. The one at the tip soon falls off and the others follow. If they fall on "good soil" they at once germinate and produce a new mycelium.

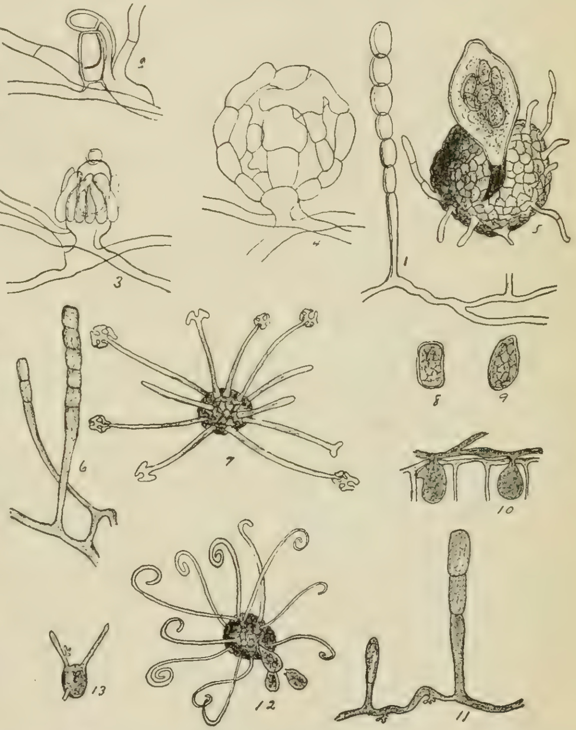

FIG. 2.—POWDERY MILDEWS OF ROSE, CHERRY, AND GRAPE.

1, summer spore of rose mildew; 2-4, development of carpogonium; 5, winter spore (perithecium) with ascus, containing ascospores escaping; 6, summer spores of cherry powdery mildews; 7, winter spore of same; 10, mycelium with haustoria in cells; 11, 12, 13, the same, of the powdery mildew of the grape. —*After De Bary.*

The winter spores are formed in much the same manner as those of the downy mildews, but their structure is far more complex. After the fertilization of the carpogonium, finger-like processes are developed around it (Fig. 2, [3]), and becoming segmented (Fig. 2, [4]) they have a cellular or raspberry appearance. From the exterior, appendages of various forms are developed. In some cases they are straight, in others forked at the extremities, and in yet others are coiled as in the Uncinula of the grape (Fig. 2, [12]). Within these sporocarps or perithecia, one or more oval bodies (asci) are developed, and inside these are the ascospores, varying in number from two to eight. These winter spores remain in their cases on the fallen leaves until spring, when the asci burst the walls of the perithecium, and the ascospores escape through orifices at the extremities of the asci. They soon germinate and the cycle is completed. As the vegetative or growing portion of the fungus is outside the host plant, it is easily destroyed by any fungicide. If the vines are in fruit, it may be found best to use the

liver of sulphur; the flowers of sulphur applied dry would also be an effectual remedy.

In the southern and western states, the *Black Rot* has for several years inflicted great damage, and in some sections well-nigh destroyed the grape-growing industry. It shows itself, soon after the leaves start, in round spots on the foliage and, later, on the fruit. The spots spread and may involve every berry in the cluster, and greatly reduce the leaf surface. This disease can be distinguished from all others, by minute black spots that appear on both leaves and fruit, and the berries on shrivelling also take on a characteristically wrinkled appearance. The Labrusca class (Concord, etc.) seem particularly subject to its attack.

We have, also, another disease of the grape, which, although it differs in every essential character from the black rot, is often mistaken for it. The fungus attacks foliage, fruit, and young shoots, and, if anything, is even more virulent. The spots on the shoots and leaves are yellowish, finally becoming dark brown, and on the fruit are distinguished from those of the black rot by a reddish ring, inclosing a whitish spot, and surrounded by a dark ring. As the disease proceeds, and envelops the berry, it shrivels away, but *does not* have the black spots, the rotten appearance, or the wrinkles that distinguish the black rot. This is becoming quite troublesome in some sections, and proves less amenable to fungicides than are the other diseases. The common name for the disease is *anthracnose*.

Treatment: If the vineyard is *badly infected* with any of these diseases it is well to carefully gather the fallen leaves, prunings, etc., and burn them, as this will destroy millions of spores. Early in the spring, before the buds start, the vines and trellises, or stakes, should be thoroughly sprayed, and for this purpose Bordeaux mixture No. 3 (or 2), will prove effectual. As soon as the buds start, they should be sprayed with some one of the copper compounds—either modified eau celeste or sulphate of copper and ammonia carbonate, and this should be repeated once in two or three weeks, until August 1 to 15, according to the variety and the prevalence of the disease. If the disease has only a slight foothold, the first application may be omitted. It is, however, of the utmost importance, that the spraying be commenced as soon as growth starts, as, with the exception of the powdery mildew, the fungi are endophytes, living within the tissues, and after the spores have germinated and gained entrance, no application will destroy the fungus. The use of fungicides has practically revolutionized the grape-growing industry.

APPLE SCAB.

In Bulletin 59, this disease was described and figured, but it may be well to state here, that the same fungus that causes the rough spots, "scab," on the fruit, also attacks the leaves. On the foliage it appears as greenish, velvety spots, and, the tissues being destroyed, they soon turn brown, dry up, and separate from the remainder of the leaf. The edges of the leaves seem most subject to attack, and, as a result, the leaves often have a ragged edge.

"A thin, transverse section through a scab spot on the fruit or leaf (Fig. 3) shows, under the microscope, clusters of short, brownish threads arising from a darker mass of roundish cells, which are seated directly upon the healthy tissue of the fruit or leaf, as the case may be. The free ends of the threads often bear pear-shaped bodies, of nearly the same color as the sup-

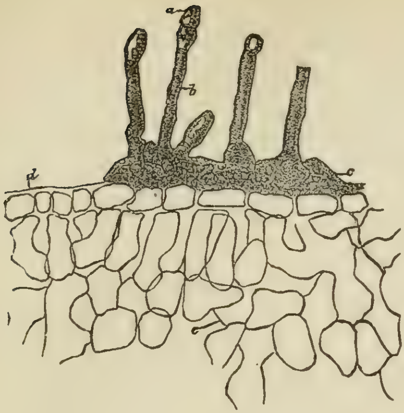

FIG 3.

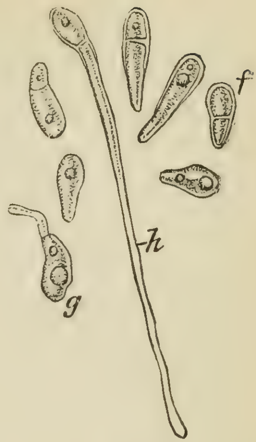

FIG. 4.

FIG. 3. Section through a scab spot. *a*, spore (conidium); *b*, hypha or supporting thread; *c* mycelium. or plant body of fungus· *d*, epidermis of apple; *e*, cells of apple. Fig. 4. *f*, spores greatly magnified; *g*, *h*, spores germinating.

porting threads; these are, as a rule, one-celled, but occasionally they are divided near the middle by a transverse partition. The pear-shape bodies (Fig. 4) are the spores of the fungus, and it is through their agency that the parasite is propagated. The brownish threads serve merely as supports for the spores, while the dark mass of tissue constitutes the body of the fungus, or, if I may so express it, its roots, branches, and leaves. When full grown the spores separate readily from their supporting stalks, and being exceedingly small and light are easily wafted from place to place by currents of air. In this way they reach healthy fruit and leaves, and, if the proper conditions of moisture and heat are present, they quickly germinate by sending out slender tubes, which bore their way into the leaves or fruit, and ultimately give rise, just beneath the cuticle or skin, to dark masses of cells like those already described. At first, this mass of fungous tissue is entirely beneath the cuticle, but, as the former continues to grow, the latter is ruptured, and it is then that another crop of stalks and spores is formed. In this way the fungus continues its development throughout the growing season, the crop of spores formed in the autumn living over winter on the old leaves, fruit, and young branches."

Another quite distinct disease, the nature of which has not been discovered, frequently attacks the leaves, and causes them to rapidly turn yellow, or brown, and drop off. Although it has no resemblance to apple scab, it is frequently mistaken for it. Not only is scab injurious to the tree, by reducing the leaf surface, and its power of assimilating food, but the fruits are reduced in size by the scab spots that form on them, they are rough and misshapen, and often, in case of certain varieties, become utterly worthless for packing.

Careful experiments, here and elsewhere, for the last three years, have shown that, even with varieties most subject to attack, a difference of from 50 to 75 per cent. can be made in the number of scabby fruits by proper application of fungicides, at an expense for labor and materials of from 10 to 15 cents for the largest trees. The treatment is exactly the same as is recommended for the grape diseases; but, if the season is not too wet, three applications will suffice.

If arsenites are used with the fungicide, as they should be for at least two applications, the trees should not be sprayed while in bloom, on account of the danger of poisoning the bees. After careful experiments for three years, we are convinced that we must look to the copper compounds for our remedies, but we have been able to find but little difference in the effects produced by the various standard mixtures, and, in selecting the kinds to use, would be guided by the relative cheapness and the ease of preparing and applying.

PEAR BLIGHT.

This dreaded disease is due to the presence in the tissues of a minute germ, known as *Micrococcus amylovorus*—Burr. They enter through the stigmas and nectaries of the flowers, through the soft tissues of the newly formed leaves and stems, or through wounds or cracks in the bark. The pear *Phytoptus* also seems to greatly increase the spread of the disease.

The character of the variety seems to have much to do with the liability of the trees to attack, as varieties that grow rapidly and develop soft, watery shoots, are more subject to the blight of the young shoots than those that grow slowly and ripen their shoots as they develop.

Trees on land rich in organic matter, make a rank growth and are very subject to the disease. Pear trees on light soils, particularly in dry seasons, and when bearing full crops of fruit, are also liable to the attack of the disease on the trunk and lower branches. Under the burning rays of the sun, the tree gives off moisture faster than the roots can take it up from the dry soil; the bark becomes parched, and growth is checked; the trunk keeps on growing and bursts the bark, exposing the live tissues below, and affords a means of access to the germs. When the tree makes a late growth in the fall, the freezing and thawing of winter often crack the bark. From the portion of the tree attacked, and the appearance of the affected portions, various names have been applied to the disease; when the trunks have been cracked by frost it is called *frozen sap blight*; if they they were ruptured owing to the scalding by the sun's rays, *fire blight* is the term used; when the new shoots are first attacked, it is often spoken of as *twig blight*. This form also attacks the apple and quince, but seldom does so much harm to them, while in the pear it frequently extends to the older portions and destroys the tree.

Whatever the means by which the germs enter the trees, or the forms in which it appears, the disease itself is due to the presence of the microbes, as can be shown by the fact that if a healthy tree is inoculated with sap from a diseased tree, the blight will be developed.

The first thing to be done as a preventive, is to avoid the conditions that favor the entrance of the germs. Select varieties that make a slow, firm growth; avoid the use of land, for pears, that is unduly rich in organic matter; head low, and so prune as to leave enough branches well down on the trunk, to protect the trunk and main branches from the midday sun; keep the surface soil to the depth of two inches stirred so as to form a soil mulch, or secure the same thing by applying a mulch of straw or marsh hay; assist the tree in maturing its wood by applying mineral fertilizers, such as wood ashes and ground bone. In case blight manifests itself on the branches, they should be cut off well below the point where the disease has appeared. Little or nothing is known concerning the efficacy of

fungicides in preventing blight, but it is quite likely that, if begun in time and persistently followed up, it would greatly reduce the amount of blight.

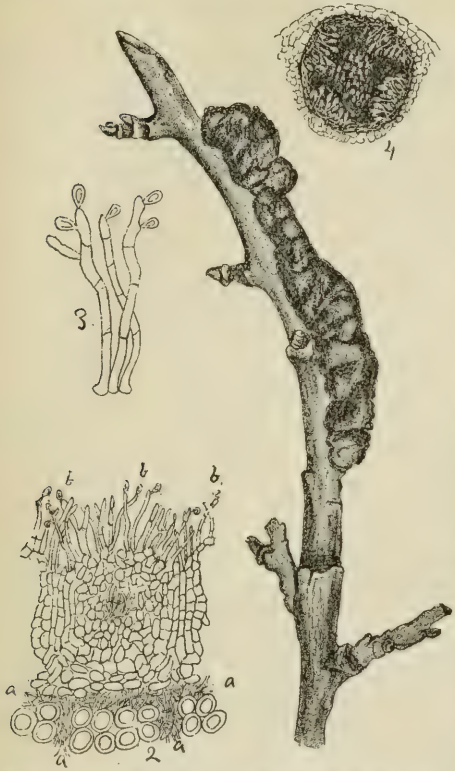

FIG. 5. BLACK KNOT. *Plowrightia morbosa.* Sacc. 1. Stem of plum tree with knot upon it, as it appears in the fall and winter.
2. Perithecium with mycelium, *a a* between the cells of the stem, and covered with filaments bearing spores, *b*, at their extremities. Section made in May.
3. Filaments and spores, (*conidia*) more highly magnified.
4. Section through a cavity containing stylospores. After Farlow.

BLACK KNOT OF THE PLUM AND CHERRY.

The plum and cherry trees, both wild and cultivated, are in some parts of the state literally covered with wart-like swellings, caused by the workings of a fungus within the tissues. It attacks the new branches as they appear each spring, and frequently kills the trees. It has just commenced to manifest itself in the principal plum-growing counties, and, if the owners are vigilant, the large orchards in the county of Oceana, and at various other points along the western side of the state may escape their ravages. The spores enter the branches during the summer, and, by the following spring, the shoots will be considerably swollen, so that the epidermis cracks, revealing the green bark underneath. During the season, a vast number of spores are produced which serve to scatter the disease. By fall the fungus has completed its growth, and will appear as a shiny, black swelling, with its surface covered with minute dots. The winter spores ripen early in the spring, and are ready to communicate the disease to the young shoots as they develop.

Careful watch should be kept at all times, and whenever a knot is seen, it should be cut off and burned. An old knot may contain millions of spores, and if dropped on the ground it will scatter its spores the same as if still on the tree. If the knots are cut off the first spring, before growth has started, no spores will have been developed, but by the next spring two crops will have matured, and the spores scattered, that may destroy every tree in the orchard. Especial attention should then be paid to the destruction of the knots while still green and soft. If the knot is on the trunk of the tree it should be cut off, and the wound painted over with linseed oil. Another remedy that is highly recommended is tincture of iodine applied in the same way. If the tree is badly affected, it should be cut down and burned. A law was passed by the last legislature, placing black knot in the same legal position as peach yellows, and the same methods can be used in securing the destruction of affected trees. Many of the spores could undoubtedly be killed by applications of fungicides, but it would need o be frequently repeated in order to secure entire immunity.

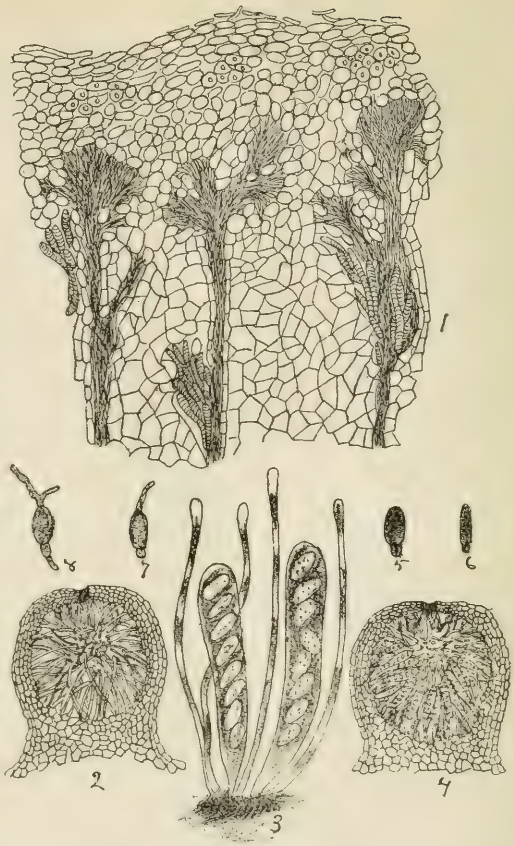

FIG. 6.—BLACK KNOT.

1. Section through deceased stem, showing mycelium.
2. Spermagonia.
3. Asci and spores.
4. Perithecium with asci.
5 and 6. Ripe Ascospores.
7 and 8. Ascospores germinating. After Farlow.

BROWN ROT OF THE STONE FRUITS.

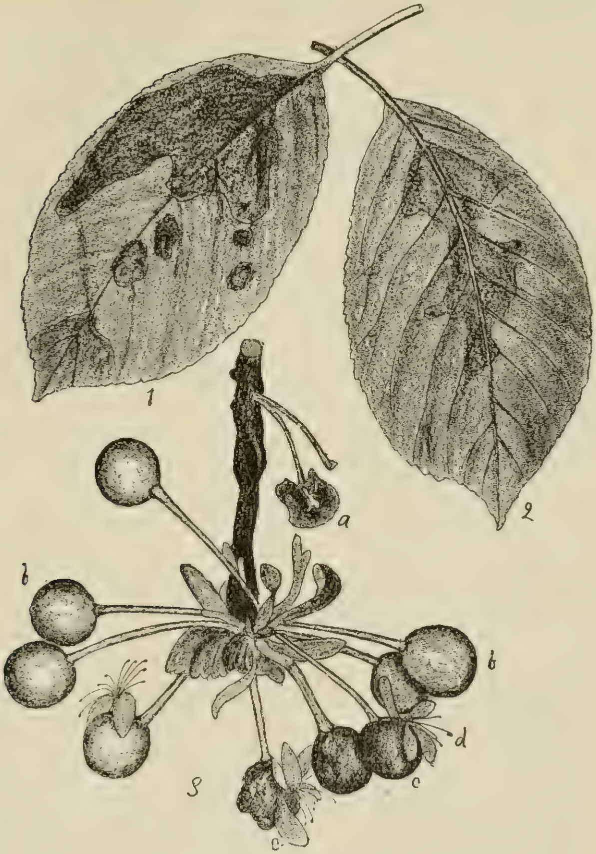

FIG. 7.—BROWN ROT OF CHERRY. *Monilia fructigena*, Pers.

1. Diseased leaf showing spots made by fungus, upper side.
2. Ditto, underside.
3. Bunch of cherries attacked by fungus.
   a. Cherry which was diseased the year before and has hung on the tree over winter.
   b. b. Green, healthy cherries.
   c. c. Diseased cherries with the blossom, d, clinging to the fruit.

—*After Galloway.*

The peach, plum, and cherry are in some seasons quite subject to this disease, which then destroys a large part of the crop. It seems particularly injurious when the fruits are not thinned, as, if two or more are in contact, moisture condenses between them, and assists in the germination of the spores. The disease is most severe in wet seasons and to trees growing in poorly drained soil. The fruit should, at all events, be well thinned and then, if sprayed soon after the fruit sets, and at frequent intervals up to August 1, the amount of fruit lost by rot would be greatly lessened. Of course all diseased fruit should be immediately destroyed.

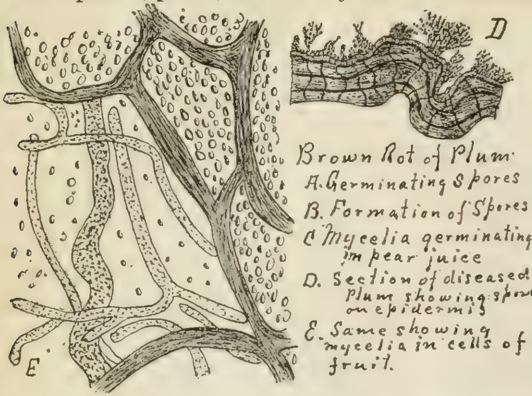

FIG. 8.—STRUCTURE OF BROWN ROT OF PLUM.—From drawing by Butterfield, Class of '91, M. A. C.

OTHER PLUM DISEASES.

Plum pockets and shot-hole fungus are common names given to fungi that often are quite injurious to the plum.

The former attacks fruit, new shoots and leaves, and causes the tissues toswell, so that, in the case of the fruit, they resemble an inflated bladder. The term *shot-hole fungus* has been given the other disease, as it attacks the leaves in circular spots, and the affected tissue dries up and drops out, so that the leaves are full of holes about the size of shot. Beyond the destruction of affected portions of the tree, nothing remains but to apply the fungicides, and to be effectual it must be frequently done.

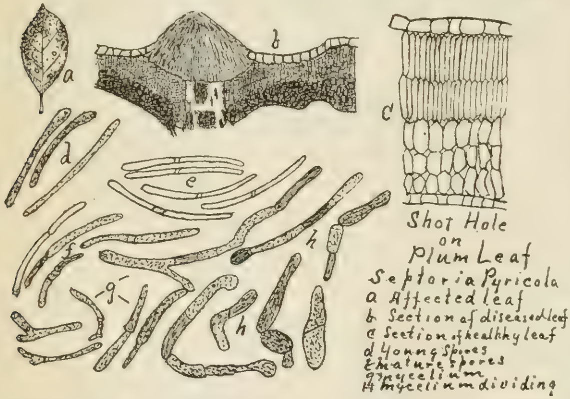

FIG. 10.—SHOT-HOLE FUNGUS (*Septoria pruni*) on plum leaf. From drawing by Stewart, class of '89, M. A. C.

FIG. 9.—PLUM POCKETS. *Taphrina pruni* (Fckl.) Tul.
1. Branch showing inflated plums.
2. Section through the outer surface of a pocket, showing the mycelium in the tissues.
3 and 4. Surface view of mycelium between epidermal cells and cuticle.
5. Section showing young asci just pushing through epidermis.
6. Asci in different stages of development, one containing spores.
7. Asci enlarged, showing development.
8. Spores germinating. After Sorauer.

LEAF BLIGHT OF THE PEAR AND QUINCE.

The genuine pear blight and the twig blight of the apple and pear are caused by bacteria, but the leaf blight is quite different in its nature, and is caused by a fungus. It is particularly injurious to pear seedlings in the nurseries, and often renders them worthless.

The copper solutions will be found perfect remedies against the disease, and, if applied at the proper time, will secure entire immunity from the attacks of the disease.

GOOSEBERRY MILDEW.

This disease proves so destructive in most sections of the country that the better (English) varieties can not be grown. The fungus is one of the easiest of all to destroy, as it lives on the exterior of its host. The disease yields readily to the copper solutions and these are perhaps best for the first applications, while after the fruit is half grown it is better to rely on the use of potassium sulphide. If the bushes are sprayed, as soon as the disease appears, it can easily be destroyed.

DISEASES OF THE SMALL FRUITS.

The strawberry, raspberry, and blackberry each have one or more troublesome diseases attacking them, and although the use of fungicides undoubtedly destroys their spores, and lessens the injury, we have not found them entirely satisfactory.

The *strawberry leaf blight*, is particularly injurious in old plantations, and when they are to be kept over to the third year, it is generally a good plan to burn over the bed, whenever practicable, after gathering the crop.

The leaves should be cut off with a mowing machine, and if there is a small amount of mulch between the rows, the beds will burn over clean, and not only the spores of the fungus, but the weed seeds are destroyed, and the land is in good shape for cultivation. It is advisable to select varieties that are least subject to the leaf blight, and if it is then likely to be troublesome, spray the vines thoroughly before growth starts, and repeat the application once in two weeks until the fruit sets. If the new leaves, that form after the patch has been burned over, show signs of being attacked, they should at once be sprayed.

The *anthracnose* of the raspberry is also most injurious to old plantations, and, when it becomes troublesome, a new one should be made, using plants free from contagion, if possible. While the copper solutions will probably keep the disease in check, if taken in time, we have had no success in preventing the development of the disease in new canes, on diseased plants.

The *yellow rust* of the blackberry, in some respects, resembles the anthracnose, in its manner of working. The spores appear in pustules on the stems and under side of the leaves, and the plant is quickly destroyed. As a rule, it is not particularly troublesome in Michigan, but it sometimes destroys entire plantations almost before its presence is noticed. The diseased plants should be dug out and burned, and the healthy plants sprayed with some fungicide to destroy any spores that may have reached them.

RUSTS AND SMUTS OF GRAINS.

Nearly all of our grains are more or less subject to the attack of various fungi, that may be included under the names of rusts and smuts. Among the most injurious is the rust of wheat.

WHEAT RUST (*Uredineæ*), FIG. 11.

Perhaps no group of fungi is so little understood as the one to which our common wheat and oat rusts belong. Although the real nature of the disease was pointed out by Sir Joseph Banks, nearly one hundred years

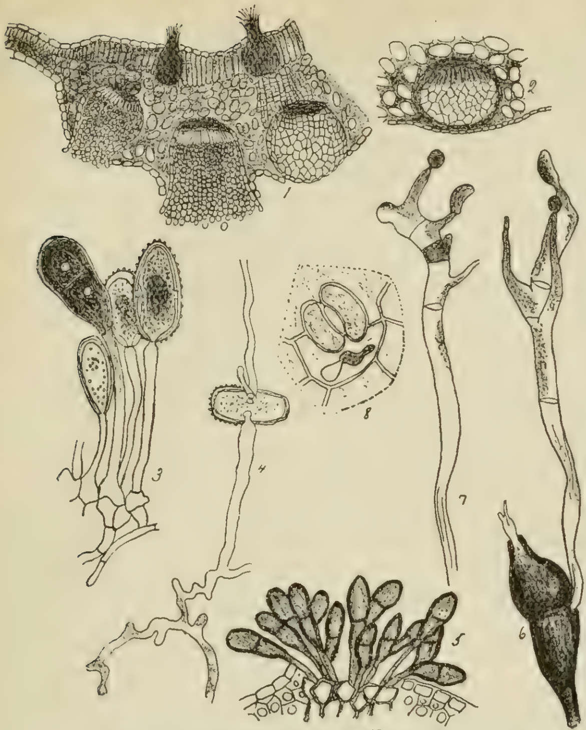

FIG. 11. *Puccinia graminis.* WHEAT RUST.
1, section of barberry leaf, showing the aecidium fruits below and spermagonia above; 2, unopened aecidium fruit; 3, three summer (uredo) spores and one teleutospores; 4, germinating uredospore; 5, cluster of winter (teleuto) spores; 6, germinating teleutospore, with sporidia forming at the end of the promycelium; 7, sporidia formed; 8, sporidia germinating on the under side of a barberry leaf and penetrating the epidermis. —*After De Bary.*

ago, a majority of the farmers account for its appearance in their field by attributing it to the rupture of the cells, or the punctures of insects allowing the sap to exude and, evaporating, leave a yellow deposit. If we examine wheat rust under a microscope, when it first appears, we shall find great numbers of elliptical spores of a yellowish color, covered with minute spines. These are supported on short stalks and have burst through the epidermis of the leaf. On becoming detached they will quickly germinate if they happen to fall in a drop of water, and if on a wheat plant will penetrate the epidermis and soon develop other spores. These yellow spores are the uredo or summer spores of the rust. (Fig. 11^3.)

If the same wheat leaf be examined during the fall, the rust spot will be seen to have become brown or black. The microscope will show the color to be owing to the presence of spores utterly unlike the yellow summer spores. They are dark-colored, two-celled, and have a thick, smooth cell wall and, as their function is to carry the fungus over winter, they are known as winter or teleuto spores. (Fig. $11,^5,^6$.) In the spring, if placed in moisture, these throw out slender threads, at the ends of which button-like protuberances are formed, known as sporidia. (Fig. $11,^6,^7$.) Under proper conditions these will develop into a new fungus, but, strange though it seems, they will not develop on the leaves of wheat plants, although they propagate readily on the leaves of the barberry. Let us follow it and see what comes of it. The upper side of the barberry leaf soon becomes yellow, and if the spot on the opposite side is examined there will be found a beautiful, cup-like cavity filled with thousands of minute golden spheres, arranged in chains (Fig. 11^1,), known as æcidiospores. If these be placed on the leaves of wheat, the characteristic rust will be produced.

Years ago, it was the belief of farmers in England and in the older states of this country, that if barberry bushes were near wheat fields there would be a great amount of rust, and with our present knowledge

this can at once be accounted for. On the other hand, rust often appears on wheat in the spring, miles from any barberry plants. How can this be accounted for? However it may be accounted for, there can be no question but that the barberry is unnecessary for the reproduction of the rust, although it may and often does supply one generation in the cycle.

They certainly develop from spores, and it has been found by experiment, that healthy plants can not be inoculated after the seeds have germinated. It must be, then, that the germs of the fungus are within the seeds, or upon them, and inoculate the radicle as it emerges from the seed. Long before anything was known of the nature of the disease, farmers discovered that the amount of rust could be greatly decreased, if the seed, before being sown, was soaked in a solution of blue-stone, or copper sulphate. We now know that its action must be on account of its fungicidal properties, and therefore it would be a rational remedy were it not for the fact that the blue-stone slightly reduces the germinating qualities of the seed, although its efficiency as a fungicide is so great that it would still be recommended, had we no better remedy. It was found by the Danish investigator, Jensen, that grain soaked in water at 132.5° F. was not injured, and that the germs of rust were so far destroyed that there was no danger of an attack.

This remedy has been thoroughly tested by Prof. Kellerman of Ohio, and others, and has proven entirely satisfactory. The only care necessary is to have the water as nearly as possible at 132.5°. If much over 135° the vitality of the seed will be destroyed, while below 130° the spores of the fungus will be uninjured. To secure the proper condition, the following method of procedure is recommended: Fill two tubs with water at 132.5°, place a half bushel of grain in a coarse bag, and dip it into one of the tubs, wetting the grain thoroughly, and warming it so that it will not cool the water in the other tub. As soon as the grain is warmed through, immerse it in the other tub and allow it to remain fifteen minutes. It should then be drained and spread out to dry. The water, after being brought to the right temperature each time, can be used over and over again.

COMBINED INSECTICIDES AND FUNGICIDES.

For most fungous diseases it is necessary to spray the plants with fungicides at intervals of from two to four weeks, during the growing season, and in many cases the same plants need to be sprayed with arsenites for the destruction of their insect pests.

The thought naturally occurred, that if the insecticides and fungicides could be put on at a single application, the labor would be reduced one half. From the experiments made here, and elsewhere, during the past two years, this seems entirely feasible under certain conditions. It has been feared by some that the chemical changes that would take place if the two were combined, would result in their losing their valuable properties, but this does not seem to be the case.

From the fact that the arsenic of Paris green is soluble in ammonia, it was also feared that there was danger of burning the foliage if arsenites were used in ammonia containing fungicides. The mixture is more likely to burn than is either substance alone, but we have used the combined insecticides and fungicides, and have found no sign of injury. When used with Bordeaux mixture there is less danger of burning the foliage than

when the arsenite is used alone, as the soluble arsenic unites with the lime, forming an arsenite of lime, a substance practically insoluble.

For the apple, pear, and plum trees, one pound of London purple can be used with safety in 250 gallons of modified eau celeste, or 300 gallons of ammoniated copper carbonate, if applied before July 1, and we seldom need to use the arsenites after that date.

Lodeman of the Cornell University experiment station,* found a slight injury from applications made during August and September, and it would hardly be desirable to use them at that time, although if really necessary to spray, both for insects and fungi, the slight injury to the foliage that would be caused, would not have any marked effect on the tree. The peach is so badly affected by soluble arsenic that, if any combination is to be used upon peach trees, Bordeaux mixture should be selected as the fungicide. Although London purple is more soluble than Paris green in water, the solubility of the former in ammonia is the greater, and is therefore to be preferred for use in ammoniated compounds.

HOW TO OBTAIN THE MATERIALS.

The retail price charged by druggists for the chemicals required for making these mixtures, has prevented many persons from using them. The increasing demand, however, has induced several firms to arrange for supplying them to fruitgrowers at wholesale rates, and that they may save to the consumer the expense of freight or express charges, on small quantities, for long distances, distributing depots will be provided in different parts of the country.

Among the firms making a specialty of this business are the Nichols Chemical Co., 45 Cedar St., New York, and W. S. Powell & Co., Baltimore, Md. The latter firm also manufactures liquid and dry copperdines, prepared Bordeaux mixture, and other ready-mixed fungicides. The crystal sulphate of copper can be obtained in five-pound packages at five cents per pound, but in barrel lots the price is only three and one half cents per pound. The powdered carbonate of ammonia costs thirteen cents per pound in ten-pound lots, or eleven cents by the barrel. For three applications the materials for spraying a full-size apple tree would cost from two and one half to three cents, or if the formula was reduced one half in strength, as is recommended by Prof. Chester, of Delaware, the price would be correspondingly less. The commercial mixtures are for sale by several of the largest seedsmen, and when one has only a few trees or vines to spray, although the price charged for them seems unnecessarily high, they will be nearly as cheap as the chemicals at drug store prices. If of standard strength, as they should be, they will answer as well as, and be easier to apply, than the home-made mixtures.

Where any number of trees are to be sprayed, the chemicals at wholesale rates will be considerably cheaper, and if the powdered copper sulphate and powdered carbonate of ammonia are used, the trouble of mixing will be very slight.

ARE FUNGICIDES AND ARSENITES DANGEROUS?

When Paris green was first used on potatoes, for the Colorado beetle,

* Bulletin 35 published December, 1891.

many persons hesitated to make use of it, fearing that they would be poisoned in applying it, or that the tubers would absorb the poison, to the injury of the persons eating them. No harm ever came from the use of arsenites, for this purpose, except through gross carelessness, and it is now the universal remedy. When arsenites were first proposed as a remedy for the codlin moth, and other insects attacking fruits, everyone had become so accustomed to the use of arsenites, that it met with little opposition on the ground of danger to health, and in many sections of the country the practice of spraying is quite general. Recently, however, some of the English journals have commenced a crusade against American apples, on account of the use of Paris green and other arsenites upon them. They have been freely used in this country for more than ten years, and no case of poison can be traced to them; and at the lowest possible estimate a person would have to eat twenty bushels of apples at a single sitting to obtain enough arsenic for a fatal dose.

When properly applied, there need be no fear from pasturing stock in recently sprayed orchards, as, when four times the usual amount of poison was used on the trees, Prof. Cook pastured sheep and a horse under them without injury.

The copper salts used in fungicides are poisons, but analysis shows that a great increase in the amount remaining on fruit at time of gathering would be necessary for them to become dangerous.

While it is unwise, for the appearance of the fruit, to use lime compounds as the fruit is ripening, the fungicides can be used with perfect safety as recommended in this bulletin.

Not only is the amount of copper too small to cause injury, but as usually applied it is in an insoluble form, and is even less dangerous.

SPRAYING OUTFITS.

The use of insecticides and fungicides necessitates the possession of proper spraying pumps. These should be carefully selected, according to the kind and amount of work to be performed. For use in small gardens, some of the small, cheap pumps, such as the Lewis, manufactured by P. C. Lewis Co., Catskill, N. Y., or of some of the various hydronettes, aquapults, etc., are desirable. For orchard purposes, the number of force pumps now on the market is almost endless, and, really, any powerful pump, if provided with proper attachments, such as suction pipe or hose, spraying hose, nozzle, return pipe or hose, etc., would answer the purpose.

PUMPS.

A large number of firms make a specialty of spraying pumps, and as these are particularly adapted to the purpose, better results may be expected from their use than from ordinary pumps.

Of the cheaper and yet efficient kinds, is the Southern Queen, sold by the Field Force Pump Co. of Lockport, N. Y. This firm also manufactures a number of other kinds that are more powerful and better adapted for use in large orchards. One recent improvement in their pumps, is in the lowering of the cylinder within the barrel or tank, which brings the pump one foot lower down, and both lessens the tendency of the barrel to tip over, and the danger of striking the branches of the trees.

The pumps made by the Nixon Force Pump & Nozzle Co. of Dayton,

Ohio, are well made, light, and yet powerful. Of the other large firms who manufacture and deal in spraying outfits are W. & B. Douglas, Middletown, Conn., Wm. Stahl, Quincy, Ill., and the Gould Manfg. Co., Seneca Falls, N. Y.

Several of these firms have large pumps, to be worked by gearing taking its power from the wagon wheels. Most of these work by means of cog-wheels, and although it may be all right upon a two-wheel vehicle, we have not found it entirely satisfactory on one with four wheels, as, in passing over uneven ground, the cogs often slip. A recent improvement substitutes sprocket wheels and an endless chain belt for the cog wheels, and will probably work all right. We have mounted a 12-bbl. stock tank on a spare wagon gear, and have it arranged so that we can work the pump either by hand or power. This is much better than to run back and forth for water, with one or two barrels, when spraying a large orchard. Fully twice the work can be done with a geared machine than can be done when pumping by hand, and with much less labor.

The gearing can be applied to any farm wagon, and will soon pay for itself, if many trees are to be sprayed.

We would advise the use of the sprocket wheels, in preference to the cog wheels, as the latter will only answer on a two-wheel cart, and then only when the shaft is carefully adjusted in its bearings, and especially when the end next the pinion is properly supported.

If they are to be used for applying fungicides, the cylinders, piston, valves, and all working parts should be of brass.

For spraying grapes, potatoes, or any other plants, not more than ten feet in height, the copper knapsack pump is very convenient. The reservoir will hold about five gallons of water, and for small fruits this will suffice to spray a considerable area before the supply need be replenished.

The improved knapsack pump made by the Field Pump Co. has a large air chamber, and in other ways it is as good, if not better than the others.

W. & B. Douglass Co. and Wm. Stahl also make knapsack pumps. In purchasing pumps, I would suggest that notice be taken of the following points in construction:

1. The material used for the reservoir: for fungicides this should always be of sheet copper, as coppered tin which has been used in some pumps will not answer.

2. The attachment of pump to tank, which should be so arranged that the pump can easily be removed, in case the lower valve becomes clogged, as may happen when fungicides are used.

3. The attachment of the rings of the shoulder straps, and the fulcrum of the pump lever, which in some of the pumps sold last year was so slight that they soon tore out, making holes in the tank.

4. The hose is best attached to the top of the pump cylinder, as when at the bottom it is carried out through the side of the tank and greatly increases the chances for leaks.

NOZZLES.

For orchard spraying, some of the graduating spray nozzles are excellent. It is well to avoid all that break the stream by means of a perforated disk, on account of the danger from clogging. The Nixon nozzles make a very fine, mistlike spray, and do excellent work.

For fungicides, on all low plants, and especially if the knapsack is used, the Vermorel nozzle is best, as this is economical of material, produces the finest kind of spray, and, if the aperture is clogged, the needle-like degorger easily removes the obstruction.

POWDER GUNS.

For the application of hellebore, slug shot, London purple, and various other insecticides in powder form, the Woodason and other bellows answer well for small plants, if only a few are grown. A simple dusting-can (a two-quart pail with a wire gauze bottom), answers well for potatoes, currants, etc. The Leggett powder gun throws the insecticide as a fine cloud for several feet, and will reach insects on the under side of leaves, and on the inside shoots and leaves of plants, that might otherwise escape. By means of an extension tube, trees ten or twelve feet in height can be dusted.

While an excellent implement, the ordinary farmer will find its price (which seems excessive), a reason for not purchasing it.

The fact that the most successful fruit and vegetable growers of the country make free use of both fungicides and insecticides, indicates that it is profitable to do so, and no one who expects to come out ahead in the race should neglect using them.

L. R. TAFT.

Agricultural College, Mich., March 19, 1892.

NEW YORK EXPERIMENT STATION BULLETINS.

THE HOLLYHOCK RUST.

Until 1886 the United States appears to have been free from this fatal visitant of the European hollyhock gardens. It appeared in eastern Massachusetts in that year, as recorded by Professor FARLOW of Harvard, and was an undoubted immigrant from Europe by means of imported seed.

In 1889 it was sent me from Geneva, N. Y., by Dr. EMERY, then of the New York experiment station, and in 1890 appeared abundantly in Ithaca. It has been sent in from other places in this state, but it has not apparently become prevalent in the Mississippi valley and westward.

Although it is not as yet a serious menace to gardeners in America, nevertheless they would do well not to neglect this warning of its approach, and ought, it seems to us, to make every effort to bring it early under control, before the soil or neglected gardens become abundantly supplied with spores, and thereby sources of infection.

As a lesson for us, the experience of the old world may be very useful. The hollyhock rust in question appeared in Europe about 1869, spread over England and the continent in a few years, increasing to such an extent that the cultivation of the choice varieties of these beautiful flowers entirely ceased in many localities, thus entailing great losses, the magnitude of which, in the aggregate, was never fully known.

It affects the host-plant after this manner: In places where it has become established it appears in May and June on the leaves, stems and petioles of the host, having apparently wintered on the radical or root leaves. Externally it is seen in spots or *sori*, which are yellow at first. As seen on the under side of the leaf, they soon become wart-like and brown, or even gray, and consist wholly of two-celled spores. These sori, and the mycelium within the leaf from which the sori spring, may so increase as to cause the leaf to wither, dry up and appear as if scorched by fire, long before the time for the appearance of the flowers. Indeed, in many cases no flowers ever appear. Where the attack is not severe, these sori may remain and the leaves continue green until the latter fall in the autumn.

Several remedies for the disease were at last found effective by European growers, and that given in the *Gardener's Chronicle* for 1874, p. 243, is added below:

Permanganate of potash, (Sat. Sol.),	2 tablespoonfuls.
Water	1 quart.

Apply to the spots and all diseased parts with a sponge, and not a syringe or sprayer.

The remedy is cheap and easily obtained.

It has been thought that the disease can not endure severe winters. The present promises to be unusually cold, and we shall watch its effect on the rust. If the prevalence of the rust in the spring demands it, a resumé of what is known concerning it will be published. Will each one interested, and acquainted with the disease send us a note of its severity in known localities, accompanied, if convenient, with a small specimen of a diseased leaf? Also, will each add the date of its first appearance in the places cited, as we shall be glad to know of its progress westward, and present geographical distribution in America.

William R. Dudley.

THE FORCING OF BEANS.

Bush beans are easily forced, and they constitute one of the best secondary winter crops. We ordinarily grow them upon cucumber, melon or other benches while waiting for the cucumbers or melons to attain sufficient size in the pots for transplanting. Beans will be ready for picking in six or eight weeks after sowing, in midwinter. Their demands are simple, yet exacting. They must have a rich moist soil, strong bottom heat, and the more light the better. We cover our benches with eight or ten inches of soil, the lower third of which is a layer of old sods. The top soil we make by adding about one part of well rotted manure to two parts of rich garden loam. The soil must never be allowed to become dry, and especial care must be taken to apply enough water to keep the bottom of the soil moist, and yet not enough to make the surface muddy. With the strong bottom heat which we use for beans, the soil is apt to become dry beneath.

Our benches are built over the pipes and are closed at the sides beneath with four-inch slats set an inch apart. In this way nearly all the heat is applied directly to the soil, only enough escaping through the spaces between the slats to aid somewhat in warming the house, in connection with one run of pipe overhead. We have a good illustration in our houses at the present writing (Dec. 27), of the accelerating influence of a bottom heat. One bench, to which no bottom heat was applied for the first three weeks, is just giving beans fit for picking. On another bench in the same house, to which heat was applied from the first and upon which the same variety was sown at the same date, the second crop of beans has been up for nearly two weeks. The lack of bottom heat delayed the crop fully four weeks. The house should be lighted, and the benches should be near the glass.

If the benches are unoccupied, the beans may be planted on them directly, but if a crop is on them the beans should be started in pots. We like to plant two or three beans in a three-inch rose pot, and transplant to the benches just as soon as the roots fill the pot.

The night temperature of a bean house ought not to fall below 60°. When the blossoms appear, give a liberal application of liquid manure every five or six days. The growth of beans should be continuous and rapid from the first, in order to secure a large crop of tender pods. The

bean is self-fertile, and therefore no pains is necessary to insure pollination, as in the case of tomatoes, and some other in-door crops. The house may be kept moist by sprinkling the walks on bright days.

The essentials of a forcing bean are compact and rapid growth, earliness, productiveness and long, straight and symmetrical pods. The Sion House answers these requirements the best of any variety which we have yet tried. The cut shows with exactness an average bench of Sion House. English growers recommend the Green Flageolet, and we have had good success with it; but it is about a week later than Sion House, and it possesses no points of superiority. German Wax (*Dwarf German Black Wax*), forces well, but the pods are too short and too crooked. It is also particularly liable to the attacks of the pod fungus. Newtown (*Pride of Newtown*), is too large and straggling in growth. We are experimenting with other varieties, including pole beans, but we are not yet ready to report upon them.

For market the beans are sorted, and tied in bunches of 50 pods, these bunches bringing varying prices, but from 25 to 50 cents may be considered an average. At these figures, with a good demand, forced beans pay well. The enemies are few, red spider being one of the worst, and this is kept in check by maintaining a moist atmosphere. Only three or four pickings of beans can be made profitably from one crop. Much of the success of bean forcing, as of all other winter gardening, consists in having new plants ready to take the place of the old ones. As soon as the old plants are removed, fork up the beds, add a liberal quantity of strong, short manure, and replant immediately.

NOTES UPON METHODS OF HERBACEOUS GRAFTING.

My attention has been called a number of times to the unsatisfactory records and directions concerning the grafting of herbaceous plants. There appears to have been very little attention given to the subject, and the scant discussions of it are mostly copied from one author to another. A few years ago I made some attempts at herbaceous grafting, but it was not until last winter that experiments were seriously undertaken. The work was put in the hands of J. R. Lochary as a subject for a graduating thesis.

The experiments were undertaken primarily for the purpose of learning the best methods of grafting herbs, but a secondary and more important object was the study of the reciprocal influences of stock and scion, particularly in relation to variegation and coloration. This second feature of the work is still under way, in one form or another, and we hope for definite results in a few years. As a matter of immediate advantage, however, herbaceous grafting has its uses, particularly in securing different kinds of foliage and flowers upon the same plant. There is no difficulty in growing a half dozen kinds or colors, on geraniums, chrysanthemums, or other plants from one stock of the respective species.

Six hundred grafts were made in our trials last winter. It was found that the wood must be somewhat hardened to secure best results. The very soft and flabby shoots are likely to be injured in the operation of

grafting, and union does not take place readily. Vigorous coleus stocks three months old, gave best results if cut to within two or three inches of the pot and all or nearly all the leaves removed from the stump. Geraniums, being harder in wood, made good unions at almost any place except on the soft growing points. The stock must not have ceased growth, however. Most of the leaves should be kept down on the stock. Scions an inch or two long were usually taken from firm growing tips, in essentially the same manner as in the making of cuttings. Sometimes an eye of the old wood was used, and in most cases union took place and a new shoot arose from the bud. The leaves were usually partly removed from the scion.

Various styles of grafting were employed, of which the common cleft and the veneer or side graft were perhaps the most satisfactory. In most instances it was only necessary to bind the parts together snugly with bass or raffia. In some soft-wooded plants, like coleus, a covering of common grafting wax over the bandage was an advantage, probably because it prevented the drying out of the parts. In some cases, however, wax injured the tissues where it overreached the bandage. Sphagnum moss was used in many cases, tied in a small mass about the union, but unless the parts were well bandaged the scion sent roots into the moss and did not unite; and in no case did moss appear to possess decided advantages. Best results were obtained by placing the plants at once in a propagating-frame, where a damp and confined atmosphere could be maintained. In some plants, successful unions were made in the open greenhouse, but they were placed in shade and kept sprinkled for a day after the grafts were made. The operations should always be performed quickly to prevent flagging of the scions. Or, if the scions can not be used at once, they may be thrust into sand or moss in the same manner as cuttings, and kept for several days. In one series, tomato and potato cuttings, which had flagged in the cutting bed, revived when grafted. And cuttings which have been transported in the mail for three days grew readily, but they were in good condition when received. The mealy bugs were particularly troublesome upon these grafted plants, for they delighted to crawl under the bandages and suck the juices from the wounded surfaces.

Although it is foreign to the purpose of this note, it may be worth while to mention a few of the plants upon which the experiments were made. Sections were taken of many of the grafts and microscopic examinations made to determine the extent of cell union. Coleuses of many kinds were used, with uniform success, and the scions of some of them were vigorous a year after being set. Even iresine, (better known as *Achyranthes Verschaffeltii*,) united with coleus and grew for a time. Zonale geraniums bloomed upon the common rose geranium. Tomatoes upon potatoes and potatoes upon tomatoes grew well and were transplanted to the open ground, where some of them grew, flowered and fruited until killed by frost. The tomato-on-potato plants bore good tomatoes above and good potatoes beneath, even though no sprouts from the potato stock were allowed to grow. Peppers united with tomatoes and tomatoes united with peppers. Egg plants, tomatoes and peppers grew upon the European husk tomato or alkekengi (*Physalis Alkekengi*). Peppers and egg plants united with each other reciprocally. A coleus scion was placed upon a tomato plant and was simply bound with raffia. The scion remained green and healthy and at the end of forty-eight days the bandage was removed, but it was found that no union had taken place. Ageratums united upon

each other with difficulty. Chrysanthemums united readily. A bean plant, bearing two partially grown beans, chanced to grow in a chrysanthemum pot. The stem bearing the pods was inarched into the chrysanthemum. Union took place readily, but the beans turned yellow and died. Pumpkin vines united with squash vines, cucumbers with cucumbers, musk-melons with water-melons, and musk-melons, water-melons and cucumbers with the wild cucumber or balsam apple (*Echinocystis lobata*).

Another interesting feature of the work was the grafting of one fruit upon another, as a tomato fruit upon a tomato fruit or a cucumber upon another cucumber. This work is still under progress and it promises some interesting results in a new and unexpected direction, reports of which may be expected later.

THE INFLUENCE OF DEPTH OF TRANSPLANTING UPON THE HEADING OF CABBAGES.

Nearly all gardeners suppose that deep setting of cabbage plants is essential to success. The plants are set in the ground up to the lowest leaves when transplanted from the seed-bed. Tests were made upon this point in 1889 with thirteen varieties, and the results showed no appreciable difference between the deep set plants and those set at the natural depth. (These resuls appeared in BULLETIN XV, page 209.) The test was repeated this year upon Early Wakefield (*Early Jersey Wakefield.*) Over two hundred plants, for which the seeds were sown under glass April 14, were set in the field May 29. They were set in six parallel rows, every other row containing plants set at the same depth as they stood in the seed-bed, and the alternate ones containing those set down to the first leaves. The soil was a heavy clay loam, unfertilized. The crop was harvested Aug. 1 and Aug. 23, and the following figures were obtained:

	No. of plants.	No. of mature or solid hds.	Per cent of plants producing mature heads.	Average weight per head.
Deep	107	82	77	1.6 lbs.
Shallow	104	89	85	1.8 "

Shallow planting gave better results than deep planting, both in the percentage of good heads and in the weight of heads. In 1889, in a larger experiment, the comparative results of the two methods were indifferent. We feel, therefore, that the common notion that deep transplanting is essential to success in cabbage-growing is at least doubtful.

THE PEACH YELLOWS.

The yellows of the peach is spreading in western New York, and it is becoming a very serious menace to peach culture. Investigations into the nature of this disease have been carried on for the last three or four years by the department of agriculture at Washington. Little has been said concerning these investigations, and people are not aware of the extent to which they have been carried. In order to learn something of their scope, I visited the Chesapeake peninsula in October and examined the field experiments under progress. Dr. E. F. SMITH is the special agent of the department of agriculture, who is investigating the disease. In this region he has eighty acres of orchard under direct experiment, forty of which, scattered through twelve orchards in Delaware and Maryland, are devoted to fertilizer tests. These fertilizer tests are above a hundred in number, and comprise treatment with nitrogen, potash, and phosphorus, and many combinations of them. He has tried all of the fertilizer remedies which have been recommended for the cure of the disease and for its prevention. These have been tried upon all kinds of soils, and upon trees of all ages. They have been used with exceeding care, and they comprise the largest field experiments of this nature, upon diseases of plants, yet made in this country. It is evident upon examining these orchards that there is no fertilizer nor combination of fertilizers which will either cure or prevent yellows Many of the fertilizers, especially those rich in nitrogen, have a wonderful effect upon the vigor of the tree, but they do not prevent yellows, nor cure it. All the investigations so far made, go to show that yellows is a specific disease, entirely independent of soil or surroundings.

Many investigations in other directions have been made, and many important facts have been obtained concerning the nature of the disease, but so far its cause has not been determined. The disease is an exceedingly obscure one, much more so than pear blight or any other disease with which we are familiar.

The New Jersey, Delaware and Maryland orchards are being rapidly decimated with yellows; in fact, the upper portion of Delaware is practically devastated of peach trees, and the upper part of the Chesapeake peninsula in Maryland is no longer a profitable peach region. There are acres upon acres of orchard in which more than every other tree is visably diseased, and in large areas it is almost impossible to find a single healthy tree. There has been very little united attempt toward controlling yellows in these regions, and for that reason this present destruction threatens the industry. It is useful to compare the results in this region with those of the Michigan peach region, where a definite law was early enacted and which has been enforced vigorously. In Michigan yellows is on the decrease and the planting of orchards is on the increase. In Maryland and Delaware, yellows is rapidly on the increase and orcharding is mostly on the decrease. The only remedy so far known is eradication of the tree as soon as the disease is seen. The disease is constitutional, and even when we have found the cause it will probably remain incurable. Yet there is no reason for undue alarm in the matter, because the experi-

ence of the Michigan growers has proved couclusively that radical measures will keep the disease in check or almost eliminate it from an country. The New York law is essentially the same as the Michigan law, and if it is rigidly enforced by healthy public sentiment, there is no reason why peach culture should not flourish. Otherwise, sooner or later our peach industry must perish.

EXPERIENCES IN CROSSING CUCURBITS.

The limits and results of crossing cucurbitaceous plants—pumpkins, squashes, melons, cucumbers—are little understood. The common notions are exceedingly vague. It is nearly everywhere supposed that all the species intermingle indiscriminately, and any statement to the contrary is likely to meet with incredulity. Yet there is reason to believe that many of the common observations concerning these plants are incorrect. All the species are exceedingly variable, and it is easy to select fruits from large plantations which bear some external resemblance to fruits of other species, and it is natural to suppose, in the present confused state of our knowledge of hybridity, that such fruits are hybrids.

I began definite experiments in crossing cucurbits in 1887, and selections and close observations were begun before that time. The work has been continued upon a large scale, and I have now made fully 1,000 careful hand pollinations, and have obtained no less than 1,000 types of pumpkins and squashes never recorded. The plantations of selections and crosses covered some eight acres this year.

The experiment is only begun. The main results of it can not be announced until further work has been done. But some of the incidental features of the research can be stated from time to time.

1. *Immediate effect of crossing.*—The "immediate effect of crossing" is a term used to denote any change which may occur in the fruit the same year the cross is made, as a result of the influence of pollen. Whatever effect the pollen may have is usually shown in the offspring of the crossed fruit rather than immediately the same season in the fruit itself. There are but few plants in which an immediate effect of crossing has been proved, and of these Indian corn is the most familiar. It is commonly said that it occurs in pumpkins and squashes, also; but it certainly does not. There has never been any immediate influence whatever in any of our crosses, except such as was due to imperfect development caused by insufficient or impotent pollen. In other words, the effects of the cross are seen only in the offspring of the fruits.

It is easy to prove, without the aid of artificial pollination, even among the most variable squashes, that there is no immediate effect. If there were an immediate effect, all the fruits upon a vine would be likely to be different, as every one would probably receive a different pollination. This diverse pollination would almost inevitably result if many varieties were planted close together, for the flowers of pumpkins and squashes are imperfect and can not pollinate themselves. But the fact is that all the fruits on any vine are alike, with some trifling exceptions in rare cases due to arrested development or the like; the essential characters of the

fruits are the same. This shows that the character of the vine is determined by the character of the seed from which it comes. My observation shows that this is invariably the case.

There is no reason, therefore, to suppose that there is ever any immediate effect of crossing in pumpkins and squashes.*

2. *Do pumpkins and squashes mix?*—No one appears to doubt the indiscriminate mixing of pumpkins and squashes. Before considering the question, it is necessary to divide the fruits called squashes into two groups. One group includes the summer and fall squashes, like the scallops, common crooknecks, cocoanut, Bergen, and the like; these belong to the same species as the field pumpkin, *Cucurbita Pepo*. These squashes cross with the ordinary field pumpkin and with each other, although the mixing even here does not appear to be indiscriminate. The other group includes the Hubbard, Marblehead, turbans, and the so-called mammoth squashes and pumpkins like Mammoth Chili and Valparaiso; these belong to a distinct species, *Cucurbita maxima*. Many careful pollinations have been made between these two classes of fruits, and in no case have seeds been procured. Sometimes the fruit will develop for a a time, and in two or three instances a summer crookneck pollinated by a turban squash has developed until half grown, and has then persisted until the end of the season, but it was seedless. All our experiments show that *Cucurbita Pepo* and *C. maxima* do not hybridize.

It is an easy matter to find fruits in any large assortment of pumpkins, or summer squashes which might be taken for hybrids with the Hubbard or turbans by a casual observer. But none of these fruits which have come under my observation—and I have seen hundreds—possess any marks of hybridity, and they have occurred in our experiments among pedigree stock which had no *Cucurbita maxima* blood in it. These so-called hybrids are nothing more than incidental variations of *Cucurbita Pepo*, and they may appear anywhere at any time.

Our experience and observation show, therefore, that the field pumpkins and the summer and the fall types of bush squashes do not mix with the running squashes of the Hubbard, Marblehead, Boston Marrow, turban, and mammoth types.

3. *Impotency of individual pollinations.*—In pumpkins and squashes the flowers are either wholly staminate or wholly pistillate, and they can not, therefore, pollinate themselves. But the two kinds of flowers are borne upon the same plant. Pollination between two flowers upon the same plant I have termed *individual pollination*, in distinction from close pollination, or pollination of the flower by itself, and from cross-pollination, or pollination between flowers on different plants. It has been shown by DARWIN and others that pollen is sometimes impotent upon the pistil of the same flower, and I have been much interested, therefore, in the relation of pollen to pistils upon the same plant in monœcious species (those in which the sexes are borne in different flowers upon the same plant). My attention was first called to this subject in 1889, when some twenty or thirty squash flowers were pollinated from flowers on the same plant. A number of fruits grew to maturity, but they invariably produced poor seeds. This year the subject was carefully examined. One

* The same observation can be made in reference to blackberries and raspberries. Over 250 successful hand pollinations were made this year between blackberries, raspberries, and dewberries in many combinations, and there were no immediate effects.

hundred and eighty-five squashes and gourd-flowers of some fifty varieties were individually pollinated. One hundred and sixty-three of these did not produce fruit. The remaining twenty-two carried fruits to maturity, but in every case these seeds were thin and worthless. These 22 fruits represented 13 bush summer squashes of various kinds, five small ornamental gourds, and four crosses between bush squashes and gourds. In cross-pollinations made during the same time and in the same manner, a large part of the crosses were successful, indicating that the failure of the individual crosses was due to the inability or the pollen to fertilize the ovules rather to incidental methods of operation. The experiment indicates that pollen of squashes which can not produce fertile seeds may still cause the development of the fruit. The influence of pollen is well attested in other instances, but it is not impossible that squashes may sometimes develop without any pollination whatever. At any rate we have found this to be the case in some other cucurbits, and it is a point upon which we are still working, and concerning which we have much data.

This impotency of individual pollen is a matter of immense importance to originators of varieties. It is commonly held that the best way in which to "fix" or render permanent new varieties, so that they will reproduce themselves by seedage, is to in-breed or close-pollinate them, but the above trials indicate that this is impossible or practically so in pumpkins and squashes. An instance in my own experience is suggestive. From stock which was crossed in 1887, I obtained in 1889 one squash of great excellence. It appeared to combine more good qualities than any squash of its type that I have ever seen. To procure as many plants of it as possible, in order to cross and fix it, I planted all the seeds from the best fruit in the spring of 1890. These seeds, all from one squash, produced 110 distinct varieties, and only one plant was like the parent! The only thing to do was to pollinate the flowers of this one plant with pollen from itself, but it soon became evident that all of these individual pollinations would fail. It was then necessary, late in the season, to pollinate the remaining flowers from some other plant which bore fruit the nearest like the one under experiment. Fortunately, two or three other plants bore similar fruits, and by the use of their pollen two good plants were obtained.

It appears, therefore, that in squashes and pumpkins the pollen is impotent upon pistils on the same plant, and that true in-breeding does not occur in them. The experiment will be extended to all varieties.

4. *Do cucumbers spoil musk-melons?*—If any dogma finds general acceptance among horticulturists, it is the opinion that musk-melons are rendered insipid and worthless by cucumbers growing in their vicinity. Most growers suppose that this influence is immediate, but a few hold that it appears only in the offspring of supposed crosses between the two species. Several years ago my observations led me to doubt this influence, but definite experiments were not undertaken until last winter, when a house of forced melons and cucumbers gave a good opportunity to make cross-pollinations. In these trials we failed to produce melons when the flowers were pollinated either by the common white spine or the English forcing cucumbers.

Last summer the work was undertaken in the garden under the best of opportunities. Ninety-seven musk-melon flowers of various varieties were pollinated by cucumber pollen of many kinds. No fruits

developed. Twenty-five cucumber flowers were pollinated by musk-melon pollen. Only one fruit developed, and that was seedless. These figures certainly indicate that melons and cucumbers do not cross, and therefore that the influence of one upon the other is fictitious. It has been suggested by one who has followed this experiment that even if the cucumber pollen will not fertilize the musk-melon, it may still exert a sort of secondary influence if applied along with musk-melon pollen. But if the cucumber pollen does not even possess the power of developing the fruit walls, as our experiments show, it is inconceivable that it should exert any influence whatever. The single seedless fruit of cucumber which developed in the musk-melon pollinations, does not prove that musk-melon pollen will cause the development of the fruit walls of the cucumber, for our experiments have shown conclusively that cucumbers will often develop to full size without any pollination whatever.* Those who make experiments in the pollination of musk-melons must bear in mind that some varieties bear perfect flowers, and the anthers must be removed before the flower opens.

Our experience indicates, therefore, that the common opinion that cucumbers spoil musk-melons is, at least, exceedingly doubtful.

5. *Progression of flowers.*—When I first began to cross the cucurbits I noticed that all plants produce far more staminate than pistillate flowers, and that the staminate flowers appear much earlier in the season than the pistillate. A study of Hubbard and Boston Marrow squashes in 1887 showed that pistillate flowers rapidly decreased in numbers during a prolonged drouth. Records were also kept of the number and time of appearing of the flowers of each sex in other cucurbits, but as those records were not published, I have had similar ones made this year. All the flowers were counted as they appeared upon two musk-melon plants, one water-melon and one cucumber plant. These plants were all treated to ordinary garden conditions; no pollinations were made upon them, and no flowers were removed, so that their characteristics as recorded below are entirely normal. In forcing cucurbits in winter, such as cucumbers, musk-melons, summer squashes, and benincasa, I have invariably noticed this same disposition to form staminate flowers first and most abundantly.

*The matter of cucumber pollination, together with notes upon the forcing of cucumbers, will form the subject of a future bulletin.

Record, 1890.

	Musk-melon. No. 1.		Musk-melon. No. 2.		Water-melon.		Cucumber.	
	Staminate.	Pistillate.	Staminate.	Pistillate.	Staminate.	Pistillate.	Staminate.	Pistillate.
July 29	1		3				4	
30	1		—				2	
31	1		—				3	
Aug. 1	1		1				3	
2	3		2		2		6	1
3	3		—		1		7	1
4	2		1		—		9	
5	7		3		1		10	
6	4		5		1		16	
7	4		3		1	1	18	
8	2		2		2		14	1
9	11		5		5		11	2
10	8		4		3	2	17	
11	9		4	1	3	1	21	2
12	18		3		5		33	1
13	10		2		2		27	1
14	12		3		6	3	16	
15	8		6		6		23	
16	17		5	1	5	1	18	
17	17		1	1	9	4	24	
18	15		4	3	7	1	20	
19	16		2		12	1	29	
20	8		4		5		37	
21	7		2		3		14	
22	31		3		10	1	18	1
23	6		1	1	5		20	
24	7		2		6		22	
25	10		2		6	2	13	
26	4		2		5		21	
27	14	2	1	2	10	2	15	
28	11	4	5	2	9		21	
29	16	2	8		14		23	
30	6	1	4	1	5	1	15	
31	8	1	3		10	2	10	
Sept. 1	1	1	3		9	1	15	1
2	3		4	1	2		12	
3	13		4		10		6	
4	24		7	1	15		30	2
5	7		6	1	9		17	
6	15		12	1	3		9	1
7	18		12	3	1		13	
8	29		2	3	2		18	
9	24	4	18	2			8	1
10	30	2	12	3			13	
11	35	1	23	3			12	1
12	3		—	—			3	2
13	10		1	1			4	1
14	47	3	15	3			5	3
15	28	2	26	3			11	3
16	17	1	8	1			6	2
17	21	3	4	3			3	2
18	19	1	7	1			6	1
19	7		2	1			6	3
20	6	Plant begins to fail.	3	4	1		4	8
21	6		5	2			6	5
22	5		19	—			5	4
23	4		20	1			13	3
24 *Frost.*			5	1			6	1
25			1	—			4	
26			—	1			8	
27			1	1			2	
28							1	
29							1	
Totals	670	28	316	53	211	23	807	54

These figures are full of significance. They show that the staminate, or male, flowers are more numerous in each case than the pistillate, or fertile, flowers, ranging from 6 to 24 times as many. They show that the pistillate flowers make their appearance later in the season—from five days in the cucumber to thirty days in one of the musk-melons. They also show that as a rule the staminate flowers continue to appear later in fall than the pistillate. Musk-melon No. 1 was a weaker plant than the others, and it began to fail by the middle of September. It is, therefore, instructive to observe that in this plant the proportion of pistillate flowers was the smallest, and that they appeared later and ceased earlier than the other plants. And the figures illustrate the common observation that the cucumber is more precocious than the melons. The figures show forcibly the necessity of starting melons early in our short seasons.

L. H. BAILEY.

PHYSALIS,* OR HUSK TOMATO.

Under the name of husk tomato, strawberry tomato, winter cherry, and ground cherry, species of physalis have come into prominent notice during the last few years. The genus physalis is somewhat allied to the tomatoes and red peppers, and like most other groups of the family it is puzzling to botanists. There are a number of native species of physalis, one or two of which are well known in some parts of the country as ground cherry, and the fruits of which are esteemed for preserves. In fact, one of these native plants (*physalis pubescens*) is the same species as the commonest husk tomato of the gardens, although the cultivated form probably came first from some tropical or sub-tropical country. This species is very widely distributed. There has been no recent attempt to distinguish the species and varieties of our culivated physalises, and knowledge of them is greatly confused. We have grown seven species, only three of which need be discussed here, as they are the only ones which appear to have been introduced into cultivation as fruit-bearing plants. These three are as follows:

1. PHYSALIS PUBESCENS. This is the common strawberry tomato of seedsmen (the Erdbeer tomato of the Germans), the dwarf cape gooseberry, golden husk tomato, and the improved ground cherry (of Childs). It is a low plant, trailing flatly upon the ground, or sometimes ascending to the height of a foot. The leaves are rather thin and nearly smooth, more or less regularly and prominently notched with front teeth. Flowers small ($\frac{3}{8}$ in. or less long), bell-shape, the limb or border erect and whitish-yellow, the throat marked with five large brown spots; anthers yellow. The husk is smooth or nearly so, thin and paper-like, prominently 5-angled and somewat larger than the small, yellow, sweetish, and not glutinous fruit. Fig. 4 is an excellent portrait of this species. The detached fruits are natural size, although the fruit is sometimes larger than these. The plant is very prolific, and the fruits are considerably earlier than in the other species. When ripe, the fruits fall, and if the season is ordinarily dry they will often keep in good condition upon the ground for three or four weeks. The fruits will keep nearly all winter if put away in the husks

*Pronounced *Fiss-a-lis.*

in a dry chamber. They are sweet and pleasant, with a little acid, and they are considerably used for preserves, and sometimes for sauce. The plant is worthy a place in every home garden. It is grown more or less by small gardeners near the large cities, and the fruits are often seen in the winter markets. The chief objection to the plant is its prostrate habit of growth, which demands a large amount of ground for its cultivation. In good soil it will spread four feet in all directions if not headed in, but as we ordinarily grow it, the plants are set in rows three or four feet apart and two or three feet apart in the row. We have made repeated attempts to hybridize this species with others, and *vice versa*, but always without success.

This physalis has been long in cultivation. It was figured by Dillenius in 1774, in his account of the plants growing in Dr. Sherard's garden at Eltham, England. In 1781–6 it was figured by Jacquin, and by him called *Physalis Barbadensis*, from the island of Barbadoes, whence it was supposed to have come into cultivation. In 1807, Martyn described it under the name of Barbadoes winter cherry or *Physalis Barbadensis*, and says that it is a native of Barbadoes. None of these authors say anything about its culinary uses. Dunal, in 1852, described it as var. *Barbadensis* of *Physalis hirsuta*, but later botanists unite Dunal's *P. hirsuta* with Linnæus' *P. pubescens*, of which this husk tomato is but a cultivated form.

2. PHYSALIS PERUVIANA. I have grown this under the names cape gooseberry (not dwarf cape gooseberry), *Physalis Peruviana*, and *P. pubescens*. As compared with the above species, it is a much stronger grower, the plant standing partially erect and attaining a height of one and a half to three feet; leaves thicker, less regularly toothed, more pointed, heart-shape at the base, and very pubescent or fuzzy; flowers larger ($\frac{1}{2}$ or $\frac{5}{8}$ inches long), open-bell-shape, the limb or border widely spreading and light yellow, the interior or throat blotched and veined with five purple spots, the anthers blue-purple. The husk is thicker and larger than in the last, somewhat hairy, and has a much longer point. This species is too late for our climate. At Lansing, Michigan, during two or three years, the flowers did not appear until the middle of August, and very few ripe fruits were obtained. Here at Ithaca perhaps a fourth of the crop ripens. The berry is yellow, not glutinous, and much like that of *P. pubescens* in appearance, but it seems to be less sweet than that species.

This plant has been cultivated for two centuries, probably. It was described and figured by MORISON in 1715 in England. In 1725 FEUILLEE gave a description of its cultivation in Peru, saying that it was then cultivated with care and was greatly esteemed as a preserve. The particular form of the species cultivated in our gardens is that which was described and figured by SIMS in 1807 as *Physalis edulis*, the "edible physalis." SIMS' account says that "this plant is a native of Peru and Chili, but is cultivated at the cape of Good Hope, in some parts of the East Indies, and more especially at the English settlement of New South Wales, at which latter place it is known by the name of the cape gooseberry, and is the chief fruit the colonists at present possess; is eaten raw, or made into pies, puddings, or preserves."

This plant is rarely sold by American seedsmen. I have grown it mostly from French seeds. I once had it from New Zealand under the name of cape gooseberry.

3. PHYSALIS CAPSICIFOLIA, "capsicum leaved" or "peper-leaved physalis." From a botanical point of view, this is one of the most interesting species

of physalis in cultivation. It is exceedingly variable, and it appears as if distinct varieties can be readily bred from it. We have grown it under two or three names. It is usually called, though erroneously, *Physalis edulis*. This name is misleading, for the fruit is really scarcely edible because of its very pronounced mawkish flavor. The fruit is far the largest and handsomist of any physalis which I have grown, and it is not improbable that we may be able to obtain a desirable variety from it. The plant is exceedingly productive, and adapts itself to almost any soil or condition. It grows erect to a height of three or four feet, bearing smooth branches and leaves. The leaves are thin, ovate or lance-ovate and variously toothed or notched. The flowers are large and open ($\frac{3}{4}$ inch or more across), the border bright yellow and the throat bearing five black-brown spots; anthers purplish. The husk is entirely filled by the large, round, sticky berry, and is sometimes torn open by it.

This plant is supposed to be native to South America or the West Indies. It was early grown in gardens, perhaps because of its supposed medicinal properties. Dr. SHERARD obtained it in Holland in the last century and grew it in his garden at Eltham, England, and DILLENIUS figured it in 1774. MARTYN described it in 1807, but says nothing about its uses. An interesting feature of the plant is its great variability. DILLENIUS figured the leaves as nearly entire, and DUNAL, who named the plant, so describes them; but the greater part of the cultivated specimens have conspicuously toothed leaves.

We have tried a number of interesting experiments with this species. A year ago one plant appeared in our plantation which bore profusely of unusually large and purple fruits, and which was very dwarf and stocky in habit. The plant was so attractive that we saved seeds of it. All the plants this year were entirely unlike the parent, being very tall growers and bearing an ordinary crop of medium green-husked fruits. But the most singular circumstance was the fact that while the plants were all unlike the parent, they were nevertheless very like each other! In other words, there was almost no variation in the offspring. Now, alongside these plants were sown unselected seeds, and from them we secured scarcely two plants alike. The first plant in the row, for instance, was low and straggling (only 16 inches high), the branches lying almost horizontal; the leaves were small and the branches green. The second plant in the row was erect (growing 3 ft. high), with large leaves and purple branches. The first nine plants represented nine very different types, the differences being, in some cases, even greater than those which ordinarily distinguish well-marked varieties of cultivated plants. Numerous attempts have been made to cross-pollinate this species, but without success.

In conclusion we may say that three species of physalis or husk tomato are cultivated for fruit. One of these, variously known as the strawberry tomato, golden husk tomato, dwarf cape gooseberry, and improved ground cherry, is well worth growing in the home garden. The true cape gooseberry is too late for this latitude. The pepper-leaved physalis, erroneously known as *Physalis edulis*, is unfit for general cultivation for fruit, although it is an interesting plant to the experimenter.

L. H. BAILEY.

PEPINO.—*Solanum muricatum.*

Within the last few years a novelty has appeared in the seedsmen's catalogue under the name of pepino, melon pear, melon shrub, and *Solanum Guatemalense.* Its botanical affinities, as well as its horticultural merits, have been a perplexity. We have now grown the plant for two seasons, in the house and out of doors, and it has proved so interesting and unique that I have prepared this account of it.

The plant is a strong-growing herb or half shrub in this climate, becoming two or three feet high and as many broad. It has a clean and attractive foliage, comprised of long-lanceolate, nearly smooth, very dark green, entire leaves. It is a profuse bloomer, the bright blue flowers reminding one of potato flowers. But one fruit sets in each flower cluster, and as this grows the stem elongates until it reaches a length of from four to six inches. The fruit itself is very handsome. As it ripens it assumes a warm yellow color which is overlaid with streaks and veins of violet-purple. These fruits are somewhat egg-shape, conspicuously pointed, and vary from twc and a half to three and a half inches in length. If the fruits are still green upon the approach of frost, they may be placed in a cool, dry room where, in the course of two or three weeks, they will take on their handsome color. If carefully handled or wrapped in paper, the fruits will keep until mid-winter or later. The fruit is pleasantly scented, and the flavor of it may be compared to that of a juicy, tender, and somewhat acid egg-plant. It is eaten either raw or cooked.

Upon the approach of winter we dig up some of the plants and remove them to the conservatory or forcing-house. It is in the capacity of ornamental plants that they will probably find their greatest usefulness in this latitude. The habit is attractive, the flowers bright and pleasant, and the fruit—if it is obtained—is highly ornamental and curious. The plant will stand a little frost.

The plant has not fruited freely with us, however, although it blooms profusely. We have endeavored to insure fruiting by hand pollination, but without success. The anthers give very little pollen. Perhaps half the plants succeed in setting two or three fruits apiece. All the fruits which we have raised have been entirely seedless, and this appears to be the common experience. The plant must be propagated by cuttings or layers therefore. We obtained our stock from a botanical specimen which I obtained from Florida, and which was not thoroughly dried.

This plant was introduced into the United States fram Guatemala in 1882 by Gustav Eisen, of California. There has been much speculation as to its nativity and its true botanical position. At first it was thought by some to be a variety of the egg-plant, but it is very distinct from that species. But the plant is by no means a novelty to science nor even to cultivation, for it was accurately described and figured so early as 1714 by Feuillée in his account of travels in Peru. He called it *Melongena laurifolia.* At that time the plant bore "several little lenticular seeds, one line broad." It was carefully cultivated in gardens, and the Indians ate it with delight. The taste is described as somewhat like a melon. Eating too heartily of it was supposed to bring on fevers. In Lima it is called pepo. In 1799 it was again described and figured by botanists visiting Peru, Ruiz, and Pavon. They described the fruit as "ovate, pointed, smooth, and shining, white variegated with purple, hanging, of the shape of a lemon." They say that it was much cultivated in Peru, and added that it

was propagated by means of cuttings. It was called "Pepino de la tierra." In 1785, Thouin, a noted French gardener, introduced it into Europe, and four years later Aiton, of the Royal Garden at Kew, England, named it *Solanum muricatum.* The specific name, *muricate* or *prickly,* was given in reference to the rough or warty character of the sprouts which spring from the root and which are often used for propagation. And now, over a hundred years later, it has found its way to us.

Mr. EISEN'S account of the pepino will be interesting in this connection. "The Central American name of this plant," he writes "is pepino. Under this name it is known everywhere in Central American highlands, and under this name only. But as pepino in Spanish also means cucumber, it was thought best to give the plant an English name. I suggested the name melon shrub, but through the error or the wisdom of a printer the name was changed to melon pear, which I confess is not very appropriate, but still no less so than pear guava, alligator pear, rose apple, strawberry guava, mango apple, custard apple, etc. * * * As to the value of the fruit and the success of it in the States, only time will tell. The fact that I found the plant growing only on the highland where the temperature in the shade seldom reaches 75° Fahr., suggested to me the probability that it would fruit in a more northern latitude. In California it has proved a success in the cooler parts, such as in Los Angles city, and in several places in the coast range, and will undoubtedly fruit in many other localities, where it is not too hot. * * * My friend, the late Mr. J. GRELCK of Los Angles, had a plantation of 10,000 pepinos, which grew and bore well and he sold considerable fruit. * * * In pulp and skin the pepino resembles somewhat the Bartlett pear, but in taste more a musk-melon; but it has besides a most delicious acid, entirely wanting in melons and quite peculiarly its own. In warm localities the acid does not develop, and this fact is the greatest drawback to the success of the fruit. The fruit has no seed, as rule. And in all, I have found only a dozen seeds, and those in fruit which came from Salama in Guatemala, a place rather to warm to produce the finest quality of fruit. The botanical name of the pepino is not known to me with certainty. The same was described by the Franco-Guatemalan botanist, Mr. ROUSIGNON, as *Solanum Melongena Guatemalense,* but it is to me quite evident that this solanum is not, nor is it closely related to, the *S. Melongena* or egg-plant, which latter is a native of central Asia. The pepino is probably a native of the central American highlands, and appears to have been cultivated by the Indians before the conquest by the Spaniards." Last year Mr. EISEN wrote that "it has only succeeded in Florida, but has there proved of considerable value."

The greatest fault of the pepino appears to be its failure to set fruit. Mr. EISEN states that in Guatemala it "yields abundantly, in fact enormously, 100 to 150 fruits to a vine four feet in diameter being nothing uncommon. I have seen it yield similarly in California, but whenever exposed to too much heat and dryness it is very slow to set fruit." He recommends that it be shaded if it refuses to set fruit. MARTIN DENSON, Dade Co., Florida, writing to the *American Gardener,* says that he has had great success with it. "I counted the fruit on a medium-size plant and found it bore sixty, of all sizes, from those just set to some nearly matured and weighing upward of a pound. The fruit varies considerably, but averages about the size of a goose egg. The fruit is the most perfectly seedless of any that I have ever seen, without a trace of a seed. It requires cool

weather in order to set fruit, and never does so excepting during a norther or cool spell, when the fruit sets in great quantities." Mr. BENSON's letter is accompanied by an admirable illustration of the fruit. In the northern states it has always proved a shy bearer, if I may judge from such records as exist. "D," writing to the *Gardener's Monthly*, says that he had "only about two pears to each plant, among literally hundreds of blossoms." *Orchard and Garden* comments upon this feature as follows: "The general experience with it here (New Jersey), thus far, seems to justify us in calling it exceedingly shy in setting fruit, and if this tendency to abortive blooming can not be overcome, the melon pear must be considered without practical value." These remarks are certainly counter to the statements and pictures made by some seedsmen in regard to its productiveness.

The pepino is an unusually interesting plant, and if it could be made to set fruit more freely in the north, it would be an aquisition for the kitchen garden and for market. It is a good ornamental plant. Altogether, it is deserving of a wider reputation. L. H. BAILEY.

CHOROGI.*—*Stachys Sieboldi.*

In 1882 Dr. BRETSCHNEIDER, physician to the Russian legation at Pekin, sent to the society of acclimatization of France tubers of a mint-like plant which is cultivated in China. The society transferred the tubers to Mr. PAILLIEUX, at Crosnes, near Paris, who grew them that season, and who has since been largely instrumental in introducing the plant to the horticultural world. Three or four years after its introduction the plant began to attract attention in France and England, and in 1887 NANDIN named it *Stachys tuberifera*, upon the supposition that it is really not the true *Stachys affinis*, under which name it had passed. It appears to have been grown in England about as early as in France, probably from some of the stock which PAILLIEUX had received or which he grew the first year. It was first exhibited in England December 13, 1887, before the Royal Horticultural society by Mr. HASKINGS, gardener to Sir HENRY THOMPSON of West Mousley. It was certificated by the society November 14, 1888. It had now been introduced to the horticultural trade, chiefly by VILMORIN of Paris, under the name of *Crosnes du Japon*, in allusion to the home of Mr PAILLIEUX where it had been most extensively grown, and in reference to the country whence it was supposed to have come originally. In the spring of 1888 it was introduced into this country under two names, *Stachys affinis* and *S. tuberifera*.. In 1890 HEMSLEY, writing of the botany of China, determined that the proper name of the plant is *Stachys Sieboldi* of Miquel.

It still remains to determine upon a good English name for the plant. Many names have been proposed, as Chinese artichoke, Japanese artichoke, knotroot, curlroot, and spirals, all of which are more or less objectionable if the plant is ever to assume any importance in trade. Some contend that the French *Crosnes du Japon* should be used, but this name does no suit an English vernacular. It is also proposed to call it by the scientific name, but a Latin name would hinder the popularizing of the plant. Again the simple generic name stachys has been proposed, but as

* Pronounced Chor'ogi: ch soft, as in *chore*; both o's long; g hard; i short, as in *it*.

other species of stachys may come into cultivation in the kitchen garden, the name might lead to confusion. I has seemed to me better to adopt some aboriginal name of the plant if a simple one can be found, and I have therefore ventured to use the Japanese name chorogi. This name has been suggested in English journals, but does not appear to have been adopted by any writer. Professor GEORGESON, who is well known as a student of Japanese plants, and Mr. TAKAHASHI, a Japanese student in the Cornell College of Agriculture, both inform me that this name is the one in use in Japan. The Chinese names for the plant are kan-lu and tsan-yungtzu.

Chorogi is a small perennial plant, with the aspect of peppermint or spearmint. It belongs to the mint family, and to a genus (stachys) which is well represented in this country. In fact, there is some doubt among botanists as to whether it is really distinct from a common wild stachys (*S. palustris*) which grows in wet places over a large part of North America. Its value to the gardener lies in the great number of crisp white tubers which it produces just under the ground. These tubers are thickened underground stems, like the potato tuber. Although the tubers are small, they are so abundantly produced as to make the plant a heavy yielder. We imported tubers in the winter of 1889–90. They were in poor condition when planted, and the growth during 1890 was small. The plants were allowed to remain without protection during the winter, and this year they have spread so as to fill a row a foot and a half wide and have produced great numbers of tubers. We have eaten the tubers in several ways and I do not hesitate to pronounce the plant the most important acquisition to our list of secondary vegetables which has been made in several years. The tubers can be cooked in a great variety of ways, or they may be eaten raw. They are fried, roasted, baked, pickled, preserved, stewed in cream and made into various fancy dishes. The tubers may be dug as wanted during the winter, and ordinarily enough of the plant will be left in the ground to propagate it the following year.

The greatest fault with the vegetable is the fact that the tubers shrivel and spoil if exposed to the air for a few hours. This will interfere with their market qualities. They can be kept in earth, however, and the French market them in moist shavings, or in sawdust. Much of their value depends upon their crispness.

This plant has been much advertised, and as it bids fair to become a vegetable of some importance, I have collected here the experiences of various growers with it.

"The *Stachys tuberifera*, a so-called new vegetable from northern Africa (China), was tested, but can not be pronounced a very great acquisition. It belongs to the mint family, and produces small, fleshy tubers, which in our trial only attained the size of acorns. Its table qualities were not tested."—*Professor Goff, before Western N. Y. Hort. Soc., 1889, 28.* Our opinion was much the same as Professor GOFF's at the close of our first season of test, but during the second year, the plants not having been disturbed, the yield was wonderfully increased, and one plant yields a mess sufficient for a family of four.

"The tubers, which are the edible part, are produced in such an abundance as to be truly wonderful, as many as 300 having been grown from a single tuber in one season. * * * Their uses and best modes of preparation for the table are not yet known. We find by mashing them and preparing as we do egg-plant, that they closely resemble the latter,

having that pleasant, spicy, characteristic flavor; and as they are as easily kept as potatoes, it is a real treat to have this very good substitute in the winter. They are also good when fried or roasted."—*John F. Rupp, Pennsylvania, in Pop. Gard. iv, 122 (1889).*

"*Stachys tuberifera* is perfectly hardy in the north of France, and accommodates itself to various soils and conditions. The tubers are small, but each plant bears a great number of them, and it is very easy to harvest them. It is essentially a winter vegetable, the tubers forming late in summer and being dug in November. It is preserved anywhere under the soil, and is not injured by the frost of winter."—*Chas. Naudin, in Manuel de l'Acclimateur, 507 (1887).*

"A year ago the Dutch horticultural journal *Sempervirens* asked for reports upon *Stachys tuberifera* for European cultivation as an article of food. Twenty-one reports were submitted, among which seventeen were favorable, recommending the plant as a valuable addition to the list of table vegetables. Good sandy soil, not too dry, is said to be the best for it, as the tubers then become beautifully white, while in heavier soil they assume a brownish color."—*Gard. and Forest, ii. 144 (1889).*

"The new vegetable * * * seems to be winning its way in Germany. It was put to proof in the proverbial way at a recent meeting of the Society for the Promotion of Horticulture in Berlin, being eaten both boiled and roasted. Some who tested it pronounced roast potatoes much better, but the majority, says a German journal, declared that the stachys tubers have a 'fine, peculiar taste, and should be highly recommended to the epicure.' "—*Gard. and Forest. ii. 600.*

"The new vegetable, *Stachys affinis*, has become quite popular in France, and is found now in all the principal fruit shops in Paris, the price varying from twelve to twenty-five cents per pound. At Amiens, one of the principal centers of production, it has been sold for fifteen francs (about $3) per hundred pounds. Some one in that city conceived the happy idea of making a preserve of the tubers. Prepared in this way they lose nothizg of their quality, and the question of keeping them is settled."—*Gard. and Forest, ii. 624.*

"I have now grown this new vegetable * * * for several years, and find it well worth extensive cultivation. It is much esteemed as a second-course vegetable, and it is also a useful ingredient in the salad dish, looks well, and is very palatable as a pickle, and is a fitting companion to the breakfast radishes. * * * The yield is quite a bushel to about 16 square yards."—*P. Middleton, Gard. Chron. 3 ser. iii. 211 (1888).*

"Where stachys has once been planted, there is always a difficulty in ridding the land of them, and it is as troublesome as couch-grass."—*W. A. Cook, in Gard. Chron. 3 ser. viii. 667.*

The following account of forcing the plant is interesting: "Sets (tubers) were planted in 12-inch pots in December, the temperature maintained being 50° to 55°. I have also grown it in cold frames, with good result, having as many as 100 tubers on one plant."—*J. Claydon, in Gard. Chron. 3 ser. iii. 460.*

Several chemical analyses show that chorogi rates fully as high as potatoes in food and fertilizer value.

From the foregoing experiences, it appears to be safe to recommend the chorogi for trial in every home garden.

L. H. Bailey.

SPANISH SALSIFY.—*Scolymus Hispanicus*, Linn.

A vegetable which promises to be of considerable value in this country, if once generally introduced, is the so-called Spanish salsify, a native of southern Europe. I have grown this for two years. It makes a root much like salsify, except that it is much lighter colored and considerably longer. Its flavor is less pronounced than that of salsify, but when carefully cooked it possesses a very agreeable quality which is somewhat intermediate between that of the salsify and parsnip. It is adapted to all the methods of cooking employed for those vegetables. The particular value of the vegetable, aside from affording a variety in the kitchen garden, is its large size and productiveness as compared with the salsify. We raise almost twice the crop upon a given area that we can secure from salsify, and no doubt it could be sold for that vegetable in the general market. The seeds are much easier to handle and sow than those of the salsify. It is sown and cultivated in exactly the same manner as that vegetable, and can be dug either in the fall or spring. Perhaps the greatest disadvantage of the plant is the very prickly leaves, which may make it unpleasant to handle. But on the whole, it is worth introduction into American gardens. Seeds are offered by some American seedsmen. Spanish salsify is closely allied to the cardoon and artichoke, and its young leaves are sometimes bleached and eaten like cardoons. Nicholson, in Dictionary of Gardening, writes that "the roots of *Solymus Hispanicus* are equally as good as scorzonera (the black salsify); the leaves and stalks are eaten as cardoons by the people of Salamanca; the flowers are employed for the adulteration of saffron." Naudin who is one of the highest authorities upon cultivated plants, makes these remarks about the species: "It is a compositous biennial of the Mediterranean region, common in the middle of France and Spain, utilized as a vegetable, but cultivated only in Spain, especially about Madrid. The plant is spiny and has the appearance of a yellow-flowered thistle. In France only the root is eaten, and this resembles that of the salsify; in Spain the midribs and petioles of the leaves are eaten, and these are sold in great quantities upon the streets of cities during many months of the year. As with other plants, this is capable of amelioration by cultivation, and it is to be regretted that it is neglected in France and that people are content to gather it in the wild state. The root is a better vegetable than that of the salsify or the scorzonera." The plant was brought to the attention of American gardeners nearly thirty years ago by Burr. He gave directions for its cultivation, and wrote as follows of the quality: "They have a pleasant, delicate flavor and are considered to be not only healthful, but remarkably nutritious." An account of it is given in the American Horticultural Annual for 1871, and the following remarks are made: "It does not seem to be quite as hardy as the salsify, some of our plants which were left out for experiment being found partly decayed in the spring. The root is considerably larger than the salsify, and less trouble to prepare, does not require so much care in cooking to prevent it from turning dark-colored, and has a milder flavor, which is by some preferred to that of the salsify. On the other hand the plant, being prickly, is somewhat unpleasant to handle, the roots being longer and more brittle are more difficult to dig, and the center is somewhat fibrous. The last named difficulty is overcome by the French by first boiling the roots, and then splitting them longitudinally and removing the tough center, which

readily separates from the outer portion, which is very tender." We have not found tough centers in our plants.

L. H. Bailey.

THE INFLUENCE OF THE DEPTH OF TRANSPLANTING UPON THE HEADING OF CABBAGES.

For three consecutive seasons we have endeavored to determine what foundation there may be for the common notion that deep-set cabbage plants give better heads and a larger proportion of heads than those set at the normal or natural depth. It is a very general practice among gardeners to set the plants to the depth of the first leaf when transplanting to the field. The results of three years' tests show that no advantage is to be gained by such practice. In 1889 the experiment was tried upon 12 varieties, about 20 plants of each being set up to the first leaf, and as many more set to the same depth at which they stood in the seed-bed. Strangely enough, one half the varieties gave better results from shallow setting and the other half better from deep setting. There were more heavy heads from the deep setting, however; 270 cabbages gave better results from shallow planting and 295 heads better from deep planting. The total average gain in weight apparently due to deep setting was 2 oz. per head. These 12 varieties were distributed into 13 lots—that is, one variety was grown twice,—and of these, three lots were sown July 2 for a late crop. Two of these three late sowings gave better results from deep setting, but the third lot, which gave better results from shallow setting, gave a greater increase in weight than either of the others. Combining all the results, it was found that the gain in weight of heads from deep setting was as 13.60 is to 13.46. This is a very small gain, and when studied in connection with the many conflicting results among thhe different lots, leads to the conclusion that the particular method of planting probably had nothing to do with the yields, for variations equally as great, and many times much greater, come from lots treated in the same manner.

In 1890 the test was repeated, the Early Wakefield cabbage being used for the purpose. The plants were grown upon a heavy and rather poor clay loam. The numerical results were as follows:

	Total No. of plants.	No. of mature or solid hds.	Per cent of plants producing mature heads.	Average weight per head.
Deep	107	82	77	1.6 lbs
Shallow	104	89	85	1.8 "

Here the shallow planting gave decidedly the better results, both in the percentage of plants producing good heads and in the average weight of heads.

In 1891 the test was again repeated, this time with Early Wakefield and Premium Drumhead. The plants were grown on a rich and well prepared loose clay loam, and all the conditions throughout the season were such as to insure a fair and uniform test. The results of this test are the following:

	Total no. plants.	No. of mature heads.	Per cent of plants producing mature heads.	Average weight per head.
Early Wakefield—*Deep*	71	70	98.6	4.26 lbs
Shallow	61	55	90.6	4.24 "
Premium Drumhead—*Deep*	30	29	96.6	5.19 "
Shallow	45	45	100.	5.37 "
Average—*Deep*			97.6	4.72 "
Shallow			95.3	4.80 "

The average result is in favor of the shallow setting so far as weight of heads is concerned, but in favor of deep setting in the percentage of plants producing good or mature heads; but the differences are slight, and are such as might be expected from two or more lots of plants treated in the same manner. The two varieties give different results, however. The Early Wakefield gives the better results from deep setting, while the Drumhead gives better results from shallow setting. In view of these conflicting results, I can not look upon the differences as due to the manner of setting.

In conclusion, we find, as a result of three years' investigation, that the depth at which strong and stocky cabbage plants are set does not influence the extent or weight of the crop.

L. H. BAILEY.

THE VERBENA MILDEW.

The verbena mildew (*Oidium erysiphioides*), which is often very destructive to house-grown plants, has been held in check in our houses by the use of sulphide of potassium ($\frac{1}{4}$ oz. to a gallon of water). A lot of thrifty and stocky young plants which were badly attacked was divided into two lots for treatment, the lots being placed in separate houses. The treated plants received a spray of the sulphide about twice a week, and although a little of the mildew could always be found, the plants were not injured. The check lot was ruined, and the plants died. It is probable that copper compounds, as the ammoniacal carbonate of copper, will be found still more effective, but our simple treatment was so successful that we found no occasion to try any other. This mildew appears upon the leaves and young shoots in white, moldlike, patches.

L. H. BAILEY.

COMBINATIONS OF FUNGICIDES AND INSECTICIDES,

AND SOME NEW FUNGICIDES.

I. EXPERIMENTS AT CORNELL.

The necessity of spraying in order to protect many of our cultivated plants from insects and fungi is now an established fact. Fruitgrowers particularly suffer from these enemies, for there is scarcely one of the

fruits commonly grown which has not several enemies that do serious damage.

The substances which are applied for the protection of foliage and fruit may be divided into two classes: 1st, those which are directed against fungi; 2d, those directed against insects. It is the common practice to apply these separately, since when combined they are supposed to have an injurious effect upon the plant. The value of a combination which would be equally effective against insects and fungi can hardly be overestimated for it would do away with almost one half of the operations which are now necessary to obtain a good crop of fruit.

Early in the year a series of experiments was planned to determine what the action of various combinations would be upon plants, fungi, and insects. Careful notes were taken at regular intervals, and I am under obligations to Professor Creelman of the Agricultural college of Mississippi, who was with us during the summer, for assistance in this respect. The results obtained are undoubtedly more accurate than they would have been had only one observer taken them.

The compounds of copper are probably the most valuable for destroying fungi, and these were used for that purpose in the combinations. The arsenites are the most effective substances for the destruction of insects and they were applied in connection with the fungicides.

Every solution which is applied in a spray against fungi or insects should, so far as possible, possess the following qualities:

1. It must be effective.
2. It must not injure the plant.
3. It must be easy to apply.

These essential points were kept in view when making the formulas, for every solution which does not possess them must be more or less imperfect. All the liquids were more easy to apply than the Bordeaux mixture.

The arsenites used were Paris green and London purple. Equal amounts of these were applied in many cases so that a comparison could be made. The London purple contained 72 per cent. of the normal arsenite of calcium, over 50 per cent. of which was soluble in water.

Paris green and London purple were not applied stronger than is recommended, except in the case of the peach. Larger quantities of the London purple may have been used in a few cases, but practically all injury which resulted from the applications, with the exception of the peach in some cases, must be due to the fungicides, or to the united action of the insecticide and fungicide.

The applications were made to branches of apple, peach, quince, and grape; rows of potatoes and egg-plants were used, others being kept as checks. Only three applications were made to egg plants; this was more than was required to destroy the insects. The foliage of the potatoes began to die about the middle of August, so that no definite observation could be made later. All applications were made with a knapsack pump and Vermorel nozzle; the combinations were mixed immediately before being applied.

None of the plants were attacked by fungi except quinces, so that it was only upon these that some of the combinations could be tested as fungicides. Potatoes and egg-plants were used to determine what action the combination would have upon insects.

The intention was to spray about every 10 days, but as much rain fell in July the applications were made more frequently. Heavy showers

occurred Aug. 4 and 13, probably washing a considerable part of the solution which had been applied from the foliage. Much rain fell after the last applications, which occurred Aug. 19, 21, and 25.

CARBONATE OF COPPER (COMMERCIAL) AND ARSENITES.

The carbonate of copper is one of our most valuable fungicides. When dissolved in ammonia it is more easily applied than the Bordeaux mixture, and is usually as effective. The ammoniacal carbonate of copper is generally made by dissolving 3 ounces of the carbonate in 1 quart of strongest ammonia, and diluting this with 22 gallons of water. This formula is recommended by most of the experiment stations; the solution has been tested upon all the plants used in these experiments, except the peach and the egg-plants, and the foliage is not injured by its use. As this fungicide was in no case applied stronger than is here given, any injury which may have followed the applications can not be ascribed to the ammoniacal carbonate of copper alone, unless it is in the case of the peach.

The carbonate of copper was applied in twelve different combinations; the following tables show the amount of injury done by each:

No. 1. The ammoniacal carbonate of copper. 3 ounces of the carbonate dissolved in 1 quart * of ammonia and diluted with 22 gallons of water. Paris green at the rate of 1 pound to 200 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 13	Apple (*Salome*)	0	0	5	10
" 22	Pear (*Seckel*)	0	5	10	20
" 27	Quince (*Angers*)	0	0	5	5
Aug. 10	Peach (*Old Mixon Free*)	40	70	80	100
" 20	Grape (*Catawba*)	0	5	5	10
	Egg-plant	0	0	0	----
	Potato (*June Eating*)	20	25	--	----

No. 2. The ammoniacal carbonate of copper, as in No. 1. London purple at the rate of 1 pound in 200 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 13	Apple (*Salome*)	0	0	10	20
" 22	Pear (*Clapp*)	0	0	10	10
" 27	Quince (*Meech*)	0	0	20	30
Aug. 10	Peach (*Old Mixon Free*)	40	60	80	80
" 20	Grape (*Diana*)	0	0	10	10
	Egg-plant	0	0	0	--
	Potato (*June Eating*)	30	30	--	--

The action of these two solutions as fungicides was determined upon the quinces. The Angers is more susceptible to the attacks of the fungus (*Entomosporium maculatum*) with which the trees were affected, than other varieties. The Meech was much more free from the disease, but still there was enough present to show the effect of the applications.

* The ammonia used in all the experiments was very strong—26° Baumé.

September 9 the sprayed branch of the Angers retained all its leaves and but little of the disease was present upon them. The rest of the tree was almost defoliated, and the leaves which still remained were badly affected. During October about one half of the leaves from this treated branch fell, while other treated branches of the same variety retained their foliage. None of the leaves of the Meech were badly diseased, but still the sprayed branch was plainly healthier than the rest of the tree. This branch also lost some of its leaves during October, but not so many as the Angers.

When these two combinations (Nos. 1 and 2) were applied to potatoes and egg-plants, the potato beetles were as thoroughly exterminated as though no fungicide had been used in connection with the arsenite.

In each case the foliage of the quince was injured by the solutions, but not so much as to cause any of the leaves to fall before the middle of October. Nor was the apple much injured by the treatment, for none of the leaves dropped; the parts injured were principally those upon which the solution gathered after application, as the edges and ends of the leaves. Very little injury was done to the central surface, and the same is also true of the pears, grapes, and potatoes. Egg-plants were not injured. Peaches suffered the most. All the leaves were shed and the shoots were in several places burned so severely that the sap exuded, and some of the twigs died. The Paris green combination was more injurious to peaches and pears, than that with London purple, while the latter combination injured the apple, quince, and potato more. No difference could be seen on grapes.

No. 3. The ammoniacal carbonate of copper, 1½ ounce of the carbonate desolved in ½ quart of ammonia and diluted with 22 gallons of water, and Paris green at the rate of 1 pound in 200 gallons of water.

Dates of applications	Plants used.	Dates of observation and per cent of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 13	Apple (*Salome*)	0	0	5	10
" 22	Pear (*Clapp*)	0	5	10	10
" 27	Quince (*Angers*)	0	0	0	0
Aug. 10	Peach (*Old Mixon Free*)	0	70	80	100
" 20	Grape (*Does*)	0	20	30	30
	Egg-plant	0	0	0	----
	Potato (*June Eating*)	10	20	----	----

No. 4. The ammoniacal carbonate of copper as in No. 3. London purple at the rate of 1 pound in 200 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 13	Apple (*Salome*)	0	0	5	10
" 22	Pear (*Clapp*)	0	0	0	0
" 17	Quince (*Meech*)	0	0	0	5
Aug. 10	Peach (*Crawford*)	20	20	70	80
" 20	Grape (*Geneva*)	0	0	10	10
	Egg-plant	0	0	0	----
	Potato (*June Eating*)	10	10	----	----

By comparing these two tables with the two preceding, it will be seen that less injury was done to the plants than by combinations 1 and 2 with the exception of the grape in one instance. The difference in the grapes may be due to the varieties. Combination No. 3 was more injurious than No. 4 to all the plants except the quince, which was uninjured by the former, as was the pear by the latter.

The action of these two combinations upon the fungus of the quince was even more marked than of the first two. The sprayed branches showed scarcely any disease Sept. 5, although the remainder of the Angers tree had lost most of its leaves, and the leaves of the Meech were badly affected. At the date of writing, Nov. 12, the foliage of both branches still persists, and in the case of the Angers the sprayed leaves are the only ones upon the tree, excepting the younger ones which appeared after the first set had fallen. From this it would appear that the beneficial action of the ammoniacal carbonate of copper as a fungicide is not diminished by the addition of either London purple or Paris green, for its action is practically the same when no arsenite is added; it is also to be observed that the weak copper combination gave better results than the strong combination in Nos. 1 and 2. Nor was the effect of the arsenite lessened, for when the combination was applied to the potato vines and egg-plants, the beetles were as thoroughly exterminated as when no fungicide had been applied in connection with the arsenites. Consequently it would appear that when the ammoniacal carbonate of copper is applied in connection with London purple or Paris green, the action of neither the carbonate nor the arsenite is weakened.

No. 5. The ammoniacal carbonate of copper, 3 ounces dissolved in 1 quart of ammonia and diluted with 22 gallons of water, and Paris green at the rate of 1 pound in 300 gallons of water.

No. 6. The ammoniacal carbonate of copper as in No. 5, London purple at the rate of 1 pound in 300 gallons of water.

In most respects the results obtained by the use of these combinations are very similar to those of the stronger solutions, 1 and 2, except in the case of apples. Their average injury is 30 per cent. greater than that which resulted from the first two combinations. The variety here used was Seek-no-further, and this is probably the cause of the difference. Solution No. 5 injured apple foliage about 30 per cent. more than No. 6. The sprayed branch of the quince was again the best on the tree, and the potato beetles were killed as before.

No. 7. The ammoniacal carbonate of copper, 1½ ounces dissolved in ½ quart of ammonia and diluted with 22 gallons of water, and Paris green at the rate of 1 pound to 300 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 11	Apple (*Seek-no-further*)	0	0	30	50
" 27	Pear (*Clapp*)	0	10	15	15
Aug. 10	Quince (*Meech*)	0	0	0	5
" 20	Peach (*Crawford*)	50	--------	60	60
	Grape (*Geneva*)	5	10	30	30
	Egg-plant	0	0	0	--------
	Potato (*June Eating*)	0	0	--------	--------

No. 8. The ammoniacal carbonate of copper as in No. 7, London purple 1 pound to 300 gallons.

Dates of applications.	Plants used.	Dates of application and per cent. of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 11	Apple (*McIntosh Red*)	0	0	0	5
" 27	Pear (*Clapp*)	0	5	10	15
Aug. 10	Quince (*Meech*)	0	0	0	0
" 20	Peach (*Crawford*)	0	20	40	80
	Grape (*Geneva*)	0	5	10	10
	Egg-plant	0	0	0	-------
	Potato (*June Eating*)	0	0	-------	-------

Although these two combinations are little more than one half as strong as Nos. 1 and 2, still the amount of injury done is about as great. The most remarkable difference between these two tables appears in the case of the apple. No. 7. injured 50 per cent. of the foliage of Seek-no-further, while only 5 per cent. of the foliage of McIntosh Red was injured by No. 8. All of this difference can scarcely be due to the difference in the combinations applied ; it is undobtedly owing to the fact that one variety can better withstand the injurious action of the combinations than the other. The difference between the quinces is not so great, but the Paris green combinations again injured the trees more than that containing London purple.

No. 9. Carbonate of copper in suspension in water, 3 ounces to 22 gallons of water. Paris green at the rate of 1 pound to 200 gallons of water.

No. 10. Carbonate of copper as in No. 9. London purple 1 pound in 200 gallons of water.

No. 11. Carbonate of copper in suspension, 1½ ounces in 22 gallons of water. Paris green at the rate of 1 pound in 200 gallons of water.

No. 12. Carbonate of copper as in No. 11. London purple 1 pound in 200 gallons of water.

These combinations also injured the foliage considerably. The McIntosh Red apple and the Clapp pear were uninjured by No. 9; 30 per cent. of the foliage of the same variety of apple was injured by No. 10. The injury to the pear foliage averages about 7 per cent. for the four combinations, and that of the quince only 5 per cent.; grapes 12½ per cent., being about equally injured by each solution. Peaches suffered more by Nos. 10 and 12, these killing some twigs; but even the least injured branch lost 40 per cent. of its leaves.

The action of these four combinations upon the fungus of the quince was not marked. Some branches seemed to be benefited and others not, but none remained so healthy as those treated by Nos. 2 and 4. As insecticides they were as effective as any of the preceding combinations.

The data regarding the action of these twelve combinations upon foliage, show that when Paris green is applied with the ammoniacal carbonate of copper the action of the combination is more caustic than when London purple is used. Also, that the addition of London purple to water holding the carbonate of copper in suspension forms a more caustic combination than when Paris green is added. In making out the following table of injuries sustained, only those varieties were considered which were treated with both arsenites, thus making the conditions in each case the same. The numbers denote the average per cent. of injury.

	Am. carb. of copper and Paris green.	Am. carb. of copper and London purple.	Carb. of copper in susp. and Paris green.	Carb. of cop. per in susp. and London purple.
Apple	27	20	0	30
Pear	12	8	5	15
Quince	7	2	5	5
Peach	80	74	60	100
Grape	30	15	10	20
Potato	15	12	0	0

In every instance ammoniacal carbonate was more caustic with Paris green than with London purple.

These results were unexpected, and could not be accounted for until a chemical analysis of the solutions had been made. Mr. Cavanaugh, assistant chemist to the station, found that the ammoniacal carbonate of copper will dissolve practically twice as much Paris green as London purple.

The larger amount of dissolved arsenic in the Paris green combinations is undoubtedly the cause of the greater injury done by them.

When these arsenites were applied with the carbonate of copper suspended in water, the combination containing London purple was more caustic in every case excepting that of the quince; potatoes were uninjured by either one.

Conclusions.—When the ammoniacal carbonate of copper is applied in connection with London purple or Paris green, the action of neither the insecticide or the fungicide is weakened.

The ammoniacal carbonate of copper gave better results as a fungicide when used at the rate of 1½ ounce dissolved in one pint of ammonia, and diluted with 22 gallons of water, than when 3 ounces of the carbonate and 1 quart of ammonia were used to the same amount of water.

The fungicidal action of the carbonate of copper suspended in water is not marked.

Even though the ammoniacal carbonate of copper, and the carbonate of copper in suspension, may have no injurious action upon certain plants when used alone, if they are applied in connection with London purple or Paris green, although these are also used in safe quantities, the combined action of the two seriously injures the foliage of some of our cultivated plants. Even when both the fungicide and the insecticide are considerably diluted, the injurious action is in many cases serious.

Paris green with the ammoniacal carbonate of copper is more caustic than is an equal amount of London purple.

When London purple is applied in connection with carbonate of copper held in suspension in water, the combination is more caustic than one in which an equal amount of Paris green is used.

Some varieties of certain fruits are apparently more susceptible to injury from the preceding combinations than others.

None of the above combinations of the ammoniacal carbonate of copper with Paris green in London purple can with safety be used upon the plants treated in this series, with the exception of egg-plants.

The injury done to foliage by the above combinations is undoubtedly due to the arsenic which is dissolved by the fungicide.

SULPHATE OF COPPER (COMMERCIAL) AND ARSENITES.

In order to test solutions of the sulphate of copper in water the following formulas were made. The tables show the results of the application:

No. 13. Sulphate of copper, ¼ pound dissolved in 22 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 13.	Apple (*Alexander*)	0	0	20	20
" 28.	Pear (*Howell*)	0	0	10	20
Aug. 11.	Quince (*Champion*)	0	0	0	0
" 20.	Peach (*Downton*)	25	40	60	70
	Grape (*Moore's Early*)	0	0	10	20
	Egg-plant	0	0	0	--------
	Potato (*Early Rose*)	0	0	--------	--------

No. 14. Sulphate of copper, ½ pound dissolved in 22 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.			
		July 22.	Aug. 8.	Aug. 22.	Sept.
July 23.	Apple (*Alexander*)	5	10	20	20
" 28.	Pear (*Howell*)	10	20	30	30
Aug. 11	Quince (*Champion*)	0	0	0	0
" 20.	Peach (*Hardwick*)	50	60	80	80
	Grape (*Rochester*)	0	0	10	20
	Egg-plant	0	0	0	--------
	Potato (*Early Rose*)	0	0	--------	--------

These tables show that all the plants were injured except the quinces, egg-plants, and potatoes, a result which was unexpected, since the use of 1 pound of the sulphate of copper dissolved in 25 gallons of water has been recommended for mildew on grapes.

Two combinations were made with each of the above formulas, using Paris green and London purple at the rate of 1 pound in 200 gallons of water, with each one. The combinations containing Paris green caused on the average 20 per cent. more injury than when the arsenite was not used. The London purple combinations increased the injury of the sulphate only 10 per cent. As the varieties treated were not the same, this result can not be regarded as conclusive. The effect of these solutions upon fungi was unsatisfactory.

Conclusions.—The action of the commercial sulphate of copper upon foliage is uncertain.

The injury done by the sulphate of copper solutions is increased from 10 to 20 per cent. by the addition of arsenites.

HYDRATE OF COPPER (FROM LABORATORY) AND ARSENITES.

Copper appears in the Bordeaux mixture in the form of the hydrate. The following shows the reactions which take place in preparing the Bordeaux mixture, and its final composition when prepared according to the formula:

6 pounds copper sulphate.
4 " lime.
22 gallons of water.

The following results were obtained by Mr. Snyder, formerly assistant chemist at the experiment station:

"In preparing the Bordeaux mixture the following reaction takes place: $Cu\ SO_4 + Ca\ (OH)_2 = Ca\ SO_4 + Cu\ (OH)_2$. Both of these new products are insoluble in water. If both the lime and sulphate of copper are chemically pure, it would require 1 pound of lime to combine with 4 pounds of copper sulphate ($Cu\ SO_4 + 8\ H_2O$). A qualitative examination of the filtered solution showed a small amount of copper hydrate (trace), calcium sulphate, due to the extreme dilution of the solution, and calcium hydrate due to the excess of lime used in making the mixture. The Bordeaux mixture when ready for use has the following composition:

Calcium hydrate in solution.
Calcium sulphate in solution.
Copper hydrate in solution (trace).
Copper hydrate precipitated.
Calcium sulphate precipitated."

Since the hydrate of copper is the active principle of the Bordeaux mixture, experiments were conducted to determine its value when applied alone.

No. 15. Hydrate of copper at the rate of $\frac{1}{2}$ pound in 22 gallons of water.

Dates of applications.	Plants used.	Dates of observations and per cent. of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 17.	Apple (*Alexander*)	0	0	0	0
" 28.	Pear (*Howell*)	0	0	0	0
Aug. 11	Quince (*Champion*)	0	0	0	0
" 21.	Peach (*Downton*)	0	0	10	15
	Grape (*Oriental*)	0	0	0	0
	Egg-plant)	0	0	0	--------
	Potato (*Early Rose*)	0	0	--------	--------

It will be seen that the peach was the only plant injured; the leaves appeared as if punctured, the holes being from $\frac{1}{16}$ to $\frac{1}{8}$ inch in diameter.

The hydrate of copper was also applied at the rate of $\frac{1}{4}$ and $\frac{1}{8}$ pounds in 22 gallons of water. The results were the same as the above, except that the peach showed less injury.

No. 16. Hydrate of copper at the rate of $\frac{1}{2}$ pound in 22 gallons of water; Paris green at the rate of 1 pound in 300 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.			
		July 23.	Aug. 8.	Aug. 22.	Sept. 5.
July 17	Apple (*Longfield*)	0	0	0	0
" 28	Pear (*Howell*)	0	0	0	0
Aug. 11	Quince (*Champion*)	0	0	5	5
" 21	Peach (*Wheatland*)	0	20	50	50
	Grape (*Moore's Diamond*)	0	10	10	15
	Egg-plant	0	0	0	--------
	Potato (*Early Rose*)	0	0	--------	--------

Here the addition of Paris green again causes a greater injury to the foliage, the quince and the grape as well as the peach being affected. The other plants were uninjured, and from this it would appear that the hydrate of copper may be of some value in combination with Paris green.

Conclusions.—The hydrate of copper when applied alone does little injury to the foliage, only the peach being affected.

When Paris green is added to the hydrate the combination is more caustic than when either is applied alone, the injury to the peach being much increased. The quince and the grape were also injured.

BORATE OF COPPER (FROM LABORATORY) AND ARSENITES.

Several combinations were made with the borate of copper to determine if it possesses any value as a fungicide, and to ascertain what its action would be when arsenites are added. This substance closely resembles the carbonate of copper and is insoluble in water. For its value as a fungicide see page 331. The following tables show its effect upon foliage:

No. 17. Borate of copper at the rate of ½ pound in 22 gallons.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.		
		Aug. 8.	Aug. 22.	Sept. 5.
July 21	Apple (*N. Spy*)	0	0	0
" 29	Pear (*Hardy*)	0	0	0
Aug. 20	Quince (*Champion*)	0	0	0
	Peach (*Globe*)	10	10	20
	Grape (*Lady Washington*)	0	0	5
	Egg-plant	0	0	0
	Potato (*Early Rose*)	0		

The peach and the grape are the only plants injured.

No. 18. Borate of copper at the rate of ½ pound in 22 gallons of water. Paris green 1 pound in 200 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.		
		Aug. 8.	Aug. 22.	Sept. 5.
July 21	Apple (*N. Spy*)	0	0	0
" 29	Pear (*Seckel*)	0	0	5
Aug. 21	Quince (*Champion*)	0	0	0
	Peach (*Globe*)	20	30	40
	Grape (*Empire State*)	0	10	20
	Egg-plant	0	0	
	Potato (*Early Rose*)	0		

The peach and the grape are again injured, and also the pear, showing that the addition of Paris green made the solution more caustic.

No. 19. The ammoniacal borate of copper, 3 ounces of the copper dissolved in 1 quart of ammonia and diluted with 22 gallons of water, and Paris green at the rate of 1 pound in 200 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent. of injury.		
		Aug. 8.	Aug. 22.	Sept. 5.
July 21	Apple (*Longfield*)	0	0	0
" 29	Pear (*Summer Doyenne*)	0	20	30
Aug. 11	Quince (*Champion*)	0	10	20
" 21	Peach (*Wheatland*)	30	60	100
	Grape (*Victoria*)	0	10	20
	Egg-plant	0	0	
	Potato (*Early Rose*)	0		

These results are very similar to those obtained under formula No. 1, with the carbonate of copper. The apple was injured more by No. 1, the peach was affected as badly, but the other plants were injured somewhat more by No. 19. The borate combination, No. 18, injured the same plants as No. 9 with the exception of the quince, and it also injured the pear, making the actions of these two combinations also about the same, although more of the borate was used. The commercial borate of copper costs about 30 cents per ounce, but it is considerably cheaper by the pound.

Conclusion—The action of the borate of copper upon foliage resembles that of the carbonate, both when applied with Paris green or with ammonia and Paris green.

CHLORIDE OF COPPER (COMMERCIAL) AND ARSENITES.

The chloride of copper is a greenish crystalline substance readily soluble in water. Its commercial value is about 10 cents per ounce, or 50 cents per pound.

This substance was also used in several combinations, but as its action upon foliage was entirely unknown the solutions were all made too strong. Later in the season it was tried again, reducing the quantities used. Its action upon fungi is shown on page 373. The following tables show the amounts of injury done to foliage:

No. 20. Chloride of copper 1½ ounces in 22 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent of injury.	
		Aug. 22.	Sept. 5.
Aug. 20	Apple (*Gravenstein*)	0	5
	Pear (*Sheldon*)	0	0
	Quince (*Mammoth*)	0	0
	Peach (*Mt. Rose*)	10	70
	Grape (*Gaertner*)	0	0
	Egg-plant	0	0

No. 21. Chloride of copper, 1½ ounce in 22 gallons of water, Paris green at the rate of a pound in 200 gallons of water.

Dates of applications.	Plants used.	Dates of observation and per cent of injury.	
		Aug. 22.	Sept. 5.
Aug. 20	Apple (*Gravenstein*)	0	10
	Pear (*Sheldon*)	5	5
	Quince (*Mammoth*)	0	0
	Peach (*Mt. Rose*)	10	90
	Grape (*Gaertner*)	0	0
	Egg-plant	0	0

Although but one application was made, the first table shows serious injury to the peach, and the apple was also affected, but only slightly. The second table shows injury to the peach, apple, and pear, the addition of Paris green again making the solution more caustic.

Conclusions.—The chloride of copper must be used in small quantities. Its caustic action upon foliage is increased by the addition of Paris green.

FUNGICIDAL VALUES OF THE NEW COMPOUNDS.

The hydrate, the borate, and the chloride of copper were applied to pumpkin and squash vines, which are usually attacked by mildew (*Oidium erysiphoides* var. *Cucurbitarum*), in order to determine their real value as fungicides more accurately than could be done upon the quinces. The Bordeaux mixture was used for comparison. Two applications were made, the first Sept. 8, the second Sept. 18. The solutions were made according to the following formula:

Bordeaux mixture, as on page 370.
Hydrate of copper. No. 1, ½ pound in 22 gallons of water.
No. 2, ⅛ pound in 22 gallons of water.
Borate of copper. No. 1, ½ pound in 22 gallons of water.
No. 2, ¼ pound in 22 gallons of water.
Chloride of copper. No. 1, 1½ ounces in 22 gallons of water.
No. 2, 3 ounces in 22 gallons of water.

None of these solutions appeared to injure the foliage. The following table shows what per cent. of the foliage was attacked by mildew September 26, when the notes were taken.

As different varieties of cucumber were sprayed, each plot had its own check which contained some vines of the same variety as those treated.

Fungicides.	Per cent injury treated.	Per cent injury untreated.
Copper hydrate No. 1	25	25
Copper hydrate No. 2	25	30
Copper borate No. 1	30	50
Copper borate No. 2	40	50
Copper chloride No. 1	10	40
Copper chloride No. 2	5	40
Bordeaux mixture	5	30

The numbers showing the per cent. of injury to the foliage treated with the copper hydrate are not strictly accurate, for the ground was so thickly covered with vines that it was difficult to apply the fungicide to all

parts of the leaves. But those parts which were easily reached were quite free from mildew, as were also the parts in which the liquid collected after the applications. The same is also partly true of the other plots, but on them the material was evenly applied. It may be that the hydrate of copper does not remain so evenly distributed upon foliage when it is applied without lime; this would largely account for the above difference.

It is impossible to give the relative merits of these fungicides after but one season's test. More trials must be made and the formulas modified before final judgment is passed. But some of the substances appear more promising than others.

Conclusions.—The hydrate of copper when applied alone is not so effective against fungi as when applied in the Bordeaux mixture. When used at the rate of ⅛ pound in 22 gallons of water, it reduced injury from fungi at least five per cent.

The action of the borate of copper as a fungicide is not very marked when the compound is applied in an undissolved condition. When used at the rate of ½ pound in 22 gallons of water it reduced injury from fungi about twenty per cent.

The chloride of copper as a fungicide gave better results than the Bordeaux mixture. When used at the rate of three ounces dissolved in 22 gallons of water it reduced the injury from mildew 35 per cent. It is the most promising of the new fungicides tested.

The Bordeaux mixture reduced injury from fungi about 25 per cent.

SUMMARY.

1. *Carbonate of Copper.*

a. The action of the ammoniacal carbonate of copper as a fungicide does not appear to be lessened by the addition of Paris green or London purple.

b. the ammoniacal carbonate of copper gave better results as a fungicide when used at the rate of 1½ ounces dissolved in one pint of ammonia and diluted with 22 gallons of water, than when three ounces of the carbonate and one quart of ammonia were used.

c. The fungicidal action of a combination of the carbonate of copper held in suspension in water, and the arsenites, is not marked.

d. Combinations of the ammoniacal carbonate of copper and Paris green or London purple, or, of the carbonate of copper suspended in water and these arsenites, have a caustic action upon foliage as a rule.

e. Paris green renders the ammoniacal carbonate of copper more caustic than does an equal amount of London purple; but

f. When London purple is applied in connection with carbonate of copper held in suspension in water the combination is more caustic than one in which an equal amount of Paris green is used.

2. *Sulphate of Copper.*

a. The effect of the combinations of the sulphate of copper and Paris green and London purple upon fungi was unsatisfactory.

b. The action of the commercial sulphate of copper upon foliage is uncertain.

c. The injury done to foliage by the sulphate of copper was increased from 10 to 20 per cent. by the addition of Paris green or London purple.

3. *Hydrate of Copper.*

a. When the hydrate of copper is applied alone it is not so effective against fungi as when applied in the Bordeaux mixture.

b. Two applications of the hydrate reduced injury from fungi at least 5 per cent. when used at the rate of $\frac{1}{8}$ pound in 22 gallons of water.

c. The hydrate of copper when applied alone did little injury to the foliage, only the peach being affected.

d The caustic properties of the hydrate is increased by the addition of Paris green. The peach was injured 35 per cent. by such a combination.

4. *Borate of Copper.*

a. The borate of copper, when applied in an undissolved condition, has little fungicidal action.

b. When applied at the rate of $\frac{1}{2}$ pound in 22 gallons of water, two applications reduced injury from fungi about 20 per cent.

c. The action of the borate of copper upon foliage was caustic when the substance was applied in connection with Paris green, or Paris green and ammonia. The foliage of the quince, apple, pear, and egg-plant suffered least when no ammonia was used. When ammonia was used only the egg-plant escaped injury.

d. The borate of copper possesses no advantages over the carbonate, but its action is similar to it.

5. *Chloride of Copper.*

a. The chloride of copper as a fungicide gave better results than the Bordeaux mixture. When used at the rate of 3 ounces in 22 gallons of water, two applications reduced injury from mildew 35 per cent.

b. Solutions of copper chloride must be weak. One application, at the rate of $1\frac{1}{2}$ ounce of the chloride in 22 gallons of water, injured the foliage of apple and peach trees.

c. Paris green increases the caustic action of a solution of the chloride of copper.

6. *Arsenites.*

a. Paris green, when applied in connection with the ammoniacal carbonate of ammonia, does more injury to foliage than would an equal amount of London purple.

b. London purple, when applied in connection with the carbonate of copper held in suspension in water, does more injury to foliage than would an equal amount of Paris green.

c. London purple and Paris green increase the caustic action of the ammoniacal carbonate of copper, of the carbonate of copper suspended in water, of the sulphate, hydrate, borate, and chloride of copper, when insecticide and fungicide were applied together.

d. The injury done to foliage by the combinations is probably due to the arsenite which is dissolved by the ammonia or the fungicide.

7. *Varieties.*

a. Some varieties of certain fruits appear to be more susceptible than others to injury from the combinations.

b. The foliage of egg-plants is the only foliage which was not injured by any of the combinations.

II. EXPERIMENTS ELSEWHERE.

It may be well to state in addition to the preceding experiments what work has been done at other stations in regard to the combinations of insecticides and fungicides. Several stations have carried on experiments in this line and the results obtained should be well known to every fruit-grower. Weed of Ohio was probably the first to do practical work in this line. In Vol. iii, p 263, of *Agricultural Science* he says: "Among the substances tested, mention may be made of copper sulphate and London purple for blight and beetles affecting potatoes; soda hyposulphite and London purple, and potassium sulphide and London purple for apple scab and codlin moth, copper sulphate and London purple for plum-fruit rot and curculio, and several other similar experiments, the results of which will be duly reported in the bulletin of our station." I can find no detailed account of these experiments in the Ohio bulletins, although it appears that satisfactory results were obtained. In 1890 a combination of the ammoniacal carbonate of ammonia, 25 gallons, and Paris green, 3 ounces, was applied to the foliage of apple, cherry, grape, pear, quince, and potato. The application was made June 21, and June 27 no injury to the foliage could be seen.

Experiments with combinations of the Bordeaux mixture and arsenites have been made by Gillette. The table shows the effect of applying lime with Paris green and London purple:

	Proportion of arsenite to water.			
	1 pound to 25 gallons.	1 pound to 50 gal. lons.	1 pound to 100 gallons.	1 pound to 200 gallons.
London purple with lime	14	4	1	0
London purple without lime	56	31	7	9
Paris green with lime	16	5	3	3
Paris green without lime	43	35	11	4

The numbers show the average percentages of injury done to the foliage of plum, apple, cherry, peach, alder, locust, poplar, grape and squash. It will be noticed that the addition of lime reduced the injury in a marked degree.

Similar experiments were carried on with white arsenic, but entirely different results were obtained. The injury done when lime was added in applying white arsenic, was from three to twenty times greater than when lime was not used.

Since the Bordeaux mixture contains a large excess of lime, the above results may also apply when this fungicide and the arsenites are used together. In fact Gillette found that "London purple (Paris green and white arsenic have not yet been tried) can be used at least eight or ten times as strong without injury to foliage if applied in common Bordeaux mixture instead of water."

Clark, of Missouri, carried on experiments in the use of Bordeaux mixture and Paris green in combination to determine the value of the mixture

for the destruction of the codlin moth and the apple scab (*Fusicladium dendriticum*). "Two rows of Jeniton trees set to fruit were selected, one of which was sprayed twice with Paris green, and the other row was sprayed once with Paris green, and once with Paris green and the Bordeaux mixture, using two pounds of lime and four pounds of sulphate of copper instead of four pounds of lime and six pounds of sulphate of copper, to twenty-two gallons of water. The effect of the copper mixture was very marked, both upon the foliage and fruit. The leaves upon the trees thus sprayed were larger, of better color, and remained on the trees much longer than those sprayed only with Paris green. The fruit was also larger, more fair, and less cracked." No injury to foliage is reported. It is certain that a combination of Paris green and the Bordeaux mixture can be applied with safety in the proportions ordinarily used; and the combination appears to be as effective as when the two materials are used separately.

Combinations of ammoniacal carbonate of copper and Paris green have been tried at some of the stations. Experiments made by Maynard of Massachusetts, show that when Paris green is applied with the fungicide, even at the rate of one pound in 500 gallons of water, serious injury to foliage results. The combinations, however, "reduced the injury from the codlin moth to 29 per cent., while where no Paris Green was used the per cent. of wormy fruit was 70." The applications showed no decrease in the amount of scab present, but in every case an increase.

The effect of applying London purple with the ammoniacal carbonate of copper, as determined by Gillette, is shown in the table. The numbers represent percentages of injury.

	1 pound to 25 gallons.	1 pound to 50 gallons.	1 pound to 100 gallons.	1 pound to 200 gallons.	Applied.	Noted.	Days standing.
Plum	.99	.90	.60	.50	July 15	Aug. 9	15
	--------	.90	.20	.35	Aug. 18	Sept. 9	22
Apple	.02	.01	0	0	July 25	Aug. 9	15
Cherry	--------	.15	.20	0	Aug. 18	Sept. 9	22
Alder	.02	.01	0	0	July 25	Aug. 9	15
Average injury	.34+	.39+	.20	.17			

"The results reached were not uniform but in the majority of cases the injury resulting was less than when water alone was used."

Gillette also used a combination of the sulphate of copper and London purple, and his conclusion is that "the severe injury resulting from applications of London purple in a simple sulphate of copper solution make it certain that this combination should never be used upon foliage."

E. G. LODEMAN,
Assistant in Horticulture.

NOTE.—Spraying to destroy injurious insects and fungi has now come to be a necessity in fruitgrowing and vegetable gardening. Much of its success depends upon the operator, however. The treatment must be timely, thorough, and persistent. Above all things, *be ready*, and begin to spray the moment the first injury is seen, or even before. Study the question during the winter, and buy the materials before spring opens. Always use the finest and most forcible spray which will reach the desired height.

There are two leading insecticides—the arsenites, and kerosene emulsion. The arsenites are Paris green and London purple. One pound to 200 gallons of water is a good proportion for apples, pears, potatoes, etc. One pound of Paris green to 300 or 350 gallons should be used on peaches. Never use London purple alone on peaches. For apple worm, begin to spray just as soon as the last blossoms fall. Kerosene emulsion is the weapon to use against all kinds of plant lice out of doors. A good formula is soft soap 1 quart, kerosene 1 pint, hot water 2 quarts. Churn the materials by pumping back into the pail for several minutes. Dilute two or three times.

There are two leading fungicides—ammoniacal carbonate of copper and Bordeaux mixture. The former is cheaper, and much more easily made and applied. Bordeaux mixture can not be thrown upon large trees. To make the former, use 3 oz. carbonate of copper, and 1 quart 22° ammonia. This stock solution will keep, if tightly corked. When used, dilute to 25 gallons. If 26° ammonia can be obtained at your drug store, it is better to use 5 oz. carbonate, 3 pints ammonia and 50 gallons water. This is the best general fungicide. For Bordeaux mixture, use 6 lbs. sulphate copper, 4 lbs. lime, 22 gals. water. Carbonate of copper costs from 40 to 60cts per pound, and sulphate about 6 cents.

The only successful combination of insecticides and fungicides yet found is made of the arsenites and Bordeaux mixture. When arsenites and ammoniacal carbonate of copper are combined, the value of each material remains, but foliage is usually seriously injured.

THE DEWBERRIES.

Within the last few years several varieties of dewberry have come into more or less prominence. The greatest differences of opinion exist as to their merits, and no systematic attempt has been made to determine their peculiarities and values. Some of them must possess value for certain purposes for they have been strongly recommended by many growers and dealers; and it is also to be considered that the presumption is against any new fruit, especially one which has been rescued from the fields, and any commendation which it receives from honest men is proof that it possesses some points of usefulness. This account endeavors to collect and sift whatever evidence may exist concerning the dewberries, and to put on record so much of the histories and varietal peculiarities as I have been able to obtain. It is important that a record should be made thus early in the history of the fruit. If similar records had been made of other native fruits, as the blackberries, raspberries, and grapes, they would have been invaluable at this time. The histories of fruits are soon lost and all definite knowledge of methods of variation and degrees of improvement is therefore impossible. This is nowhere better illustrated than in dewberries themselves, for although they are among the most recent additions to our fruits, I have found it impossible to learn the exact histories of all of them. For several months I have carried on a large correspondence concerning them, and have followed every clew to their origins and histories.

At first thought it seems strange that such unqualified encomiums and sweeping condemnations could be bestowed upon any fruit as have fallen to the lot of the dewberry. But there are reasons for these disagreements, some of which the following pages may discover. Most fruits receive both praise and censure, for there are few which succeed in all parts of the country and under all kinds of management; and if the fruit is wholly new in kind it is particularly liable to be misunderstood and mismanaged. But it further turns out upon investigation that the varieties of dewberry are very dissimilar, and therefore not always comparable with each other and not equally adapted to given conditions. In fact, they represent two distinct species and two marked natural or botanical varieties. It is there-

fore necessary, before proceeding to a discussion of their horticultural values, to distinguish their botanical characteristics. A year ago I made an attempt to discover the botanical features of the dewberries, and the results were published in the *American Garden* for November, 1890, and February, 1891, the former issue containing the first accurate drawing of the Lucretia. The main features of the present discussion of the botany of the dewberries are drawn from those papers.

In common speech, the word dewberry is applied to any trailing blackberry. There are several distinct species or types of trailing blackberry, with only three of which we need to concern ourselves at present. It would seem as if the dewberries could be at once distinguished from the true or bush blackberries by their trailing habit, but there are some forms of wild blackberry which are low and decumbent. The botanies even describe a true trailing form of the bush blackberry (var. *humifusus*), but I am convinced that this is an error. This variety appears to have been founded upon a dewberry itself. There appears to be no true trailing form of the bush or common blackberry. The best distinction between the dewberries and bush blackberries lies in the inflorescence or flower clusters. In the dewberries the flower clusters are cymose—the center flower opening first,—and the flowers are few and scattered. In the blackberries, on the other hand, the clusters are essentially corymbose or racemose, —the lower or outer flowers generally opening first—and the flowers are usually borne in rather dense clusters. The dewberries are also distinguished by propagating from "tips," while the blackberries propagate by suckers.

The three common species of dewberry are *Rubus Canadensis*, *R. hipisdus. and R. trivialis*. The first two are northern species and the last southern.

Rubus hispidus is a very slender plant, rarely rising at all above the surface of the ground, and growing both in swamps and upon barren sand. The leaflets are obovate, stiff, and shining above. The flowers are few and very small, and the fruit is small and usually red. The species appears to posses no value as a fruit, and yet it is often confounded with *Rubus Canadensis*, which is the parent of some of our cultivated varieties. *Rubus Canadensis*, to which the term dewberry is usually restricted in the north, is much like the southern dewberry, *Rubus trivialis*, in appearance. The chief distinguishing points are these :

Rubus Canadensis or northern dewberry: Main stems or canes rather sparsely and slightly prickly; leaves thin and deciduous, either destitute of prickles or bearing only weak ones, and more or less hairy; leaflets ovate; sepals often prolonged and leaf-like, and sometime lobed.

Rubus trivialis or southern dewberry: Main canes mostly thickly beset with stout prickles; leaves firm and nearly or quite evergreen, smooth or very nearly so, the petioles or midribs usually bearing stout prickles ; leaflets oval-oblong or almost lanceolate and small; sepals not prolonged nor cut. This species is common from Delaware to Florida and Texas on the sandy lands. The canes often grow ten or fifteen feet in length. It is variable, and attractive varieties are often found. Some forms have even been mentioned as possessing value as ornamental plants.

The northern dewberry is a very variable species. In any locality where it grows in abundance a number of unlike forms may usually be found. Some of the forms are probably worthy of botanical names. To this species or its botanical varieties most of the cultivated dewberries belong. It is readily divided into three sections or sub-types.

1. The common dewberries, or *Rubus Canadensis* proper. Here belong the Windom or Cook's Hardy, Lucretia's Sister, and Geer. The leaves vary greatly in size and shape, those upon the bearing canes being small, while those upon growing canes may be nearly as large as the leaves of Lucretia. This species was founded by Linnæus. Dr. N. L. BRITTON, of Columbia college, examined the original specimens in London for me last summer, and he finds that Linnæus apparently founded the species upon two distinct plants, one of which is the form of dewberry under consideration, the other being a bush blackberry of which Dr. BRITTON proposes to write later. Linnæus' description applies to a trailing plant, and his dewberry specimen may, therefore, be taken as the type of *Rubus Canadensis*; and this is the sense in which the species has been understood by American botanists.

2. The Lucretia sub-type, variety *roribaccus*. As compared with *Rubus Canadensis* proper, this variety is a much larger and stronger grower; leaves large and the margins doubly serrate with small teeth, and more or less notched or jagged; leaflets broad at or below the middle, sometimes triangular ovate; peduncles or flower stems much longer, straighter, and stouter, more erect, habitually more numerous and more conspicuously overtopping the leaves; flowers very large and showy (often two inches across); sepals uniformly larger, some of them much prolonged and leaf-like and conspicuously lobed (sometimes becoming an inch long and wide); fruit much longer and larger as a rule, and more or less thimble-shape. Strong forms of *Rubus Canadensis* itself often look much like this in foliage, but I have never seen any in which there was such a development of long flower stems, large flowers and fruits, and large sepals. The Lucretia appears to be the only variety of this sub-type in cultivation.

3. The Bartel sub-type, or var. *invisus:* This form of *Rubus Canadensis* is particularly distinguished by the large and nearly simple teeth of the leaves. Canes stout and stiff, often partially ascending; leaflets much larger than in the species, broad and thin, smooth or very nearly so, the teeth usually very large, simple, and often rounded and terminating in a minute point; peduncles or flower stems long and straight; young flower buds commonly bearing a prominent tip formed by the connivent ends of the sepals; flowers commonly larger than in the species. As the wild plant grows here at Ithaca and as it is seen in the cultivated varieties, it appears to be very distinct from *Rubus Canadensis* and I have sometimes thought that it may be a distinct species. But there appear to be intermediate forms, and the exact position of the variety can not be determined until our rubuses have received further study. To this variety belong Bartel, General Grant and Never Fail dewberries. It grows here upon a rocky hillside, completely covering the ground with a tangled mat a foot or a foot and a half thick. The first ripe fruit on this wild patch appeared this year July 22. The fruits are small, containing from six to eighteen drupelets, and are of no value.

The dewberries are essentially like the blackberries in methods of growth. They bear fruit upon last year's canes, and these canes die or become weak after they have fruited. The methods of cultivating dewberries differ greatly. Some prefer to allow the canes to lie upon the ground and others train to a trellis or rack. As the cultivated dewberries represent such widely different types, the methods of cultivation are considered under the discussion of varieties. The greatest fault of the dewberries appears to be the failure of the flowers to set fruit. The causes of this failure are

unknown, but there is reason to suppose that more careful training, pruning, and heading-in will overcome some of the difficulty. Dewberries propagate naturally by means of "tips," after the manner of the black raspberry, and they grow readily from root cuttings handled in the same way as those of raspberries and blackberries. It has been thought by some that the low and early varieties of blackberry, like Wilson's Early and Early Harvest, may be hybrids between the blackberry and dewberry. This idea was probably first expressed by the *Gardener's Monthly*. There is no good reason, however, for supposing that these varieties are hybrids, while there are several reasons for believing that they are not. The two species do not cross with readiness, and there is no direct proof that hybridization can occur between them. We have made many apparently successful cross-pollinations, but have not yet been able to make the crossed seeds grow.

Wild dewberries are common on poor, sandy lands throughout the territory east of the Mississippi, at least, and it is well known that they are variable in appearance and in character of fruit. Large-fruited and very productive varieties are occasionally found. In many parts of the country the dewberries are thought to be better than blackberries. Files of the older journals contain frequent references to the dewberries, with occasional suggestions that they should be cultivated, but until about twenty years ago no definite attempt appears to have been made to introduce a named variety or form, and it is only within the last five or six years that they have begun to make any impression upon our horticulture. The dewberries have received little attention from botanists, as is shown by the fact that the very well marked variety *invisus* of the common dewberry has never been recognized. And yet cultivated forms of it have come from Ohio, Tennesee, and Illinois; and it grows wild here at Ithaca, and is probably generally distributed.

Twelve varieties of dewberry have been introduced to cultivation: Windom, Lucretia's Sister, Geer, Lucretia, Bartel, Mammoth, General Grant, Never Fail, Fairfax, Manatee, Wilson's White, Bauer. Five of these have attained considerable prominence: Windom, Lucretia, Bartel, Mammoth, and Manatee.

1. WINDOM (*Rubus Canadensis*)—This variety was first brought into prominent notice in 1887 by the seedling commissioner of the Minnesota State Horticultiural society. The report of J. S. HARRIS, one of the commission, is as follows: "At Windon (Cottonwood county) we met DEWAIN COOK of Dale township, a wide-awake man who is pursuing fruit culture under many disadvantages. He has discovered and is cultivating a hardy dewberry which, if it comes near up to what he claims for it, will prove of great value to our lists of hardy fruits. It has been cultivated here thirteen years. We have many testimoniols showing its hardiness, productiveness, fair size, and good quality of fruit, etc., and have secured plants and had them sent to several of our experiment stations to be tested and reported upon." A. W. SIAS, one of the commission, writes me as follows: "In the fall of 1887, J. S. HARRIS, Rev. G. W. FULLER, and myself were on the seedling commission of the Minnesota State Horticultural society, and while acting in this capacity Mr. HARRIS and myself visited DEWAIN COOK at Windom and were greatly pleased with the dewberry. His plants were very heavily loaded with good fruit. The fruit is small—perhaps not more than half the size of Lucretia—but what it lacks in size it more than makes up in quality. I purchased 1,000 plants of Mr. COOK while at his place, and set them on a very heavy clay. While they succeeded much better than the Mammoth and Lucretia near by, they did not equal Mr. COOK'S plants, which were on soil containing some sand." The variety appears to have been sent out as early as 1886, at least to experiment stations. It was first known as Cook's Hardy. The exact origin of this dewberry is not known. Mr. COOK informs me that he obtained his plants from a neighbor, J. Q. PICKETT, who had been growing them for seventeen or eighteen years, but who refuses to disclose the origin of the variety. Mr.

PICKETT came from Iowa and it is commonly thought that he brought the dewberry with him and that it grew wild in that state. Mr. COOK resides near the Mennonites, and some have supposed that the variety was originally introduced by them from Russia, but I fail to find anything in the botanical features of the plant which leads me to suspect any other than an American origin. It looks like a large-leaved and thrifty form of *Rubus Canadensis*, and I have seen similar wild varieties, and bearing apparently as large fruit, upon the eastern shore of lake Michigan.

I have collected here all the information which I have found concerning the value of the Windom. Mr. COOK, the introducer, writes me as follows: "The Windom has about all the peculiarities of the species. Sometimes it does remarkably well, and at other times it fails entirely. I am much concerned in finding some method whereby a good crop of dewberries of any variety can be produced as certainly as a crop of raspberries. The canes of the Windom are very hardy, though more tender than the Snyder blackberry. The fruit is of the size of Snyder or a trifle larger but not so good in quality, although its quality is above that of Lucretia. It is excellent for canning, excelling any of the blackberries for this purpose. The fruit often sun-scalds very badly, and the plants should therefore be grown in partial shade. I grow them in a shady orchard. I plow under a part of the patch every spring and let the plants start fresh from the roots. I never cultivate them. I think that with garden culture they form a too dense mass of vines, thereby choking themselves to death. At least it seems to be a peculiarity of the Windom that under such conditions the fruit-bearing canes die just before the fruit matures. After plowing, the dewberry sprouts from the roots, the grass and weeds grow enough to catch snow and afford winter protection, and the next season the weeds furnish protection to both foliage and fruit. The fruit is larger in dense shade than in full exposure to sun. I never saw such fine large dewberries as we found this season on some almost forgotten vines of Lucretia which were growing in a closely planted bearing plum row and which were completely covered by raspberry suckers. The vines were small, but the berries were very large. Mr. PICKETT one year had a crop of extra fine Windoms among the weeds. The next season he kept the plants clean and they produced nothing but nubbins. One spring I dug a lot of two-year-old suckers, set them out and cultivated them well, and they produced, the same season, a few very fine berries and no imperfect ones. The undisturbed row from which the plants were taken produced only imperfect fruit."

The following discussion of the Windom occurred at the annual winter meeting of the Minnesota State Horticultural society in January, 1889:

"Mr. SIAS—Last year, fourteen miles north of Windom, I saw dewberries on good rich soil that were of better quality than any I had ever seen before.

"Mr. GOULD—They were cultivated?

"Mr. SIAS—Yes they were known as the Windom dewberry or Cook's Hardy dewberry.

"Mr. SMITH—Mr. PEARSE states he has seen both varieties growing and I would enquire as to their shape, size, and color.

"Mr. PEARSE—The Lucretia was the larger but the Windom is much more productive. The shape is a little oval. I grew them last year.

"Prof. GREEN—Do you think they would be profitable as a market crop?

"Mr. PEARSE—I think the Windom will be very profitable indeed. I plant them in rows, with the plants set two or three feet apart in the row, cultivate thoroughly, but carry the runners around in matted rows. The fruit comes out on the top like strawberries. I put mine out only last spring. Those I saw in bearing that I referred to were grown by Mr. STUBBS of Long Lake. I raised a few last year and expect a nice crop another season. I would put them on the poorest ground.

"Mr. DARTT—And make make it rich?

"Mr. PEARSE—No, I would not.

"Mr. SMITH stated that he had seen a fine crop of dewberries growing wild in the vicinity of Hamlin in the summer of 1884, and had examined in the locality each year since but failed to find any. He had been to Mr. Cook's place and examined the Windom and it resembled the berry just referred to. He had raised some fruit last year but found it a very shy bearer. They might do better if covered until late in spring.

"Mr. HARRIS—I think the dewberry is a native over every part of Minnesota. There are patches of it in Houston county and have been for thirty-five years; in that time there have been three crops. This past year the crop was immense; the vines were loaded down with fruit. We have two distinct species. Occasionally we find a plant a little different from those of Mr. COOK, but the majority have the same leaf and habit of growth. The Windom does not branch so much as the common wild variety. Mr. COOK has fruited it every year with one exception. While distinct, it is a variety of

the same species as the other. The trouble seems to be that there is only an occasional crop produced.

"Mr. TAYLOR—We have heard about the dewberry bearing regularly. In 1856, when I came to Minnesota, in the section of country where I live, there were no blackberries for eight or ten years. About 1865 in the vicinity of Forrestville they were very numerous, and people would come from miles around to gather them. But there have been none to amount to anything since, either cultivated or any other way; so the dewberry is not an exception in that respect.

"Mr. HARRIS—I think the reason why the crop is a failure in that locality is that it is not as favorable as in some others. In our county last year dewberries were so plentiful as to spoil the market for tame berries. They produced so profusely that we could not get rid of our tame ones at living prices.

"Mr. PEARSE—I think there will be no difficulty in growing the dewberry successfully all over the state."

In the revised fruit list for 1889 adopted by the Minnesota society, Windom and Lucretia dewberries are recommended for trial.

Professor KEFFER, horticulturist of the South Dakota experiment station, speaks as follows of the dewberry: "This is a trailing form of the blackberry, and where it can be sheltered from the hot summer winds it should prove successful. The Windom originated in southwest Minnesota. It was loaded with fruit on the station grounds last season, but the plants were fully exposed to the wind and sunshine and comparatively few fruits matured. The mature fruit resembles the blackberry in size and flavor. It is a promising fruit for South Dakota if covered in winter and planted in a protected place." Professor C. B. WALDRON, in speaking of dewberries in Bulletin 2 of the North Dakota experiment station, does not mention Windom, but says: "The one variety of this [dewberry] to be recommended is the Lucretia."

The Windom has not been tested outside the northwestern states to any extent. W. J. GREEN of the Ohio experiment station, made the following report of it in 1888: "Not fully tested, but the plants are quite healthy and prolific. On young plants the berries are somewhat lacking in size but are said to improve in this particular as the plants attain age. There seems to be no reason to doubt its hardiness." Mr. GREEN writes me recently that the variety "has the fault of not filling out the fruit, nearly all the berries being nubbins."

T. T. LYON reports the following observations upon the Windom in southwestern Michigan: Earliest bloom, June 15; vigor, 4 (in a scale of ten, in which the Lucretia stands 5); size, 4? (Lucretia 10). I saw the variety growing in Mr. LYON's grounds last summer, in sun in sandy soil, and it appeared to possess only indifferent merit, at best.

F. L. WRIGHT, Plainfield, Michigan, sends me a cane of the Windom taken Nov. 12, which is full of flower buds. He writes: "The leaves are nearly all gone and the canes are loaded with buds, and there are some flowers." He says that the Windom is with him the heaviest cropper of all the dewberries and is the best of all except Lucretia.

Professor TROOP makes some observations for Indiana upon Lucretia and Windom, and I combine them below, together with records of a couple blackberries for comparison:

Variety.		When ripe.	Vigor of plant.	Hardiness.	Productiveness.	Size.	Quality.	Firmness.
Lucretia,	1889	July 1	5	8	8	10	9	5
	1890	July 30	6	8	9	10	10	5
Windom,	1889	July 8	3	4	3	5	5	5
	1890	July 1	3	4	3	4	5	5
Early Harvest,	1889	July 5	3	4	3	5	9	8
	1890	June 30	6	4	5	5	8	9
Snyder,	1889	July 10	10	10	9	7	10	5
	1890	July 6	10	10	10	8	9	7

These figures place the Windom low in all desirable points for Indiana. No indications are given of the kind of soil upon which they grew or the treatment they received.

From the foregoing evidence we must conclude that the Windom dewberry possesses promise, particularly for the northwest, that it demands a partially shady location, that it often fails to set fruit and sometimes produces nubbins or imperfect berries. It is often profitable, but further experience is necessary to determine the best methods of managing it under all conditions.

2. LUCRETIA'S SISTER (*Rubus Canadensis*).—This berry was discovered or at least introduced by J. B. TREEDWAY of Brandt, Miami county, Ohio, about 1886. I grew it in 1887, and a sprig of the plant is illustrated in the *American Garden* for last February (p. 83). It appeared to possess no value with me, and I have not grown it since. It appears never to have attained to any reputation.

3. GEER (*Rubus Canadensis*).—This variety was discovered in a wood-lot upon the property of a Mrs. GEER of Plainfield, Livingston county, Michigan, by F. L. WRIGHT, a horticulturist of that place. Plants were transferred to the garden in 1887, but it is not yet introduced to the trade. It is a small berry, but a fair cropper.

4. LUCRETIA (*Rubus Canadensis* var. *roribaccus*).—This is far the most prominent of the dewberries. The story of its discovery and introduction is told me by B. F. ALBAUGH of Covington, Miami county, Ohio, who introduced it to the trade. A young man named Williams enlisted in the civil war from Miami county, Ohio. During most of his service he was stationed in West Virginia, part of the time near Beverly. While guarding private property there he became acquainted with the woman who afterward became his wife. He settled on her plantation after the war, and upon it found the dewberries growing wild. He transplanted some to his garden, and these attracted the attention of his father who visited him in 1875. The following year plants were sent to the father in Ohio and they were distributed among a few friends. The plants were carelessly dug, however, and only five of the genuine variety happened to be in the lot and these, along with many worthless ones, chanced to fall into the hands of Mr. Albaugh. From these five plants the present stock has sprung. When the variety was offered for sale Mr. ALBAUGH named it Lucretia, for Mrs. LUCRETIA GARFIELD. Mr. Albaugh tells me that the five original plants are still vigorous and fruitful. A portion of one of the original plants—about one ninth of it—was exhibited at the association of American nurserymen at Washington in June, 1886. This specimen bore 978 berries. E. Y. TEAS, now of Irvington, Indiana, appears to have been the first to figure and offer for sale the Lucretia.

There are several methods of training the Lucretia dewberry. It is commonly allowed to lie upon the ground. The canes are cut back to three or four feet in length in the same manner as blackberry and raspberry canes are treated, and if the best results are expected the canes should be thinned to four or five in a hill. The canes are usually allowed to branch freely, although it is evident that some checking of the growth may often be essential to good results. A mulch is often placed under them to keep the berries clean and to retard the weeds. When this is applied, the vines are raised with a fork. A. M. PURDY recommends two stakes, one to hold the bearing cane, and one the growing cane. This implies that only one cane is to be allowed to fruit each year. This method does not appear to be in practice and it is doubtful if it has anything to recommend it. Trellises and racks of various kinds have been devised. In our plantation of Lucretia we have tried three methods of training. In one portion of the plantation the plants are allowed to lie upon the ground without mulch, and the canes are cut off when three or four feet long. Another portion is trained upon a common grape trellis of three wires, the canes being tied to the wires the spring of the bearing year by means of wool twine. In the third portion the vines lie upon a flat rack standing 18 inches above the ground, and made of light slats laid crosswise the row and resting upon bents at the sides. There has been no gain in productiveness or earliness upon the trellised or racked plants; the only advantages have come from the greater ease of picking and cultivating and the less amount of room occupied. And these advantages are considerable, and seem to me to warrant the adoption of some simple trellis, preferably a wire trellis in garden culture. Whether it would pay in field or market culture is a question which must be determined by the grower himself. The labor of tying the canes to the wires is somewhat onerous, but it is needed only once in the season. This training does not interfere with covering for winter protection, for the young or growing canes are allowed to lie upon the ground and are tied up the following spring. If the canes interfere with cultivation while growing they can be placed lengthwise the row with a rake or they can be thrown over the lowest wire. After the canes have borne, they are cut out, in the same manner as the canes of raspberries and blackberries.

One of the chief merits of the Lucretia is its earliness. Dewberries, raspberries, and blackberries grow side by side in our plantations, and we have had, therefore, a good opportunity to observe the earliness of the Lucretia. This year the first ripe raspberries—Marlboro and Rancocas—were obtained July 4. At this time a few dewberries were about fully grown and had turned red. July 8 a few ripe dewberries were secured. July 11 dewberries on some of the vines were ripening rapidly, and at this time Ada raspberry was just ripening and Doolittle and Souhegan were in their prime. July 16 Early Harvest blackberry, our earliest sort, gave its first ripe fruits, while the first pick-

ing of Agawam was not obtained until July 22. July 16 there were no flowers to be found upon the dewberries, but the blackberries were still blooming freely. A week later, pickings from the dewberries had practically ceased. It will be seen, therefore, that the dewberries ripen with the earliest black raspberries. But it must be said that there is great variation in the time of ripening between different plants, a point which will be discussed further on.

In size of fruit and productiveness the best plants of Lucretia are all that can be desired. The quality of the Lucretia is a moot point. With us this year the quality was certainly inferior. The berries lack sweetness and character. This is well illustrated by the fact that our customers declined to buy the dewberries when the blackberries began to ripen, although the dewberries were the more attractive in appearance. Others, however, maintain that the Lucretia is superior in quality to the blackberry. Much undoubtedly depends upon the season and the soil. The following extracts from a discussion before the Ohio Horticultural society are in point:

"Mr. PIERCE—I wish to differ about this question of flavor. It is very much the same flavor as the Wilson. It is not as good, in my opinion as the Lawton. It lacks flavor.

"Mr. PALMER—I differ with Mr. PIERCE in reference to the flavor of the Lucretia dewberry.

"Mr. CRAWFORD—Last year I fruited the Lucretia dewberry, with one or two other varieties; and a number of people tasted it at our house, and I never heard one person complain of its flavor. They thought it was very good indeed. But we thought the Agawam was a little better.

"Secretary CAMPBELL—There are reasons, I think, why some think it very good and others not very good. One is that it colors before it is thoroughly ripe, and if you eat it as soon as it is black it is sour. But when fully ripe it is as good as anything of the blackberry kind which I have ever eaten."

In a series of reports in the *Rural New-Yorker* in 1885 the following remarks are made concerning the flavor of Lucretia:

EDITOR—"Though of good quality when fully ripe, they are rather sour if picked sooner. This may be said of all blackberries, but more especially of this, if judged from its first season of fruiting."

R. G. CHASE & Co.—"Good quality."

T. T. LYON—"Of very good flavor." Mr. LYON reaffirmed this opinion to me this summer.

J. S. COLLINS—"Of good quality."

G. W. CAMPBELL—"When fully ripe, I think it is as good as the best blackberry I ever tasted."

J. H. HALE—"In quality far superior to any other cultivated blackberry, or dewberry I have ever tested."

The Lucretia is rather soft in texture, but it will evidently carry well in transportation. It is attractive in shape and packs well in the box.

One of the advantages of all dewberries is the ease with which they can be protected in the winter, and this must serve to render them attractive to northern fruitgrowers. The canes are probably no hardier than those of the blackberry, but the natural protection of the earth and snows often carries them through winters which seriously injure blackberries. I find the following remarks concerning the hardiness of the Lucretia:

"They have never been killed here by cold winters. In the colder climates they could be very easily covered."—*N. H. Albaugh, Ohio Hort. Rep., 1886, 25.*

The following records appear in a discussion of the Lucretia in the *Rural New-Yorker in 1885*: "The vines are thus far hardy."—*Editor.* "It did not suffer any from the severity of the past winter."—*R. G. Chase & Co., Western New York.* "With me it has so far been very productive, yielding a fair crop this year, when nearly all the blackberries fail to fruit in consequence of injury from the severe cold of last winter."—*T. T. Lyon, Southwestern Michigan.* "I have now fruited it two years, and find it both hardy and productive."—*J. T. Lovett, New Jersey.* "Valuable * * * here in New England where the valuable early market varieties [of blackberry] are not hardy enough to stand our winters."—*J. H. Hale, Connecticut.*

"It is hardy and a great bearer."—*Mr. Fluke, before Iowa Hort. Soc., 1886.*

W. J. GREEN of the Ohio experiment station commends it because of its hardiness.—(*Bulletin 5, 1888, 72; 7th Rep. 115*).

"Killed to the ground."—*C. W. Minott, Vt. Exp. Sta. 4th Rep. 184.*

"Nor has it sustained its reputation for hardiness."—*John Craig, Central Experiment Farm, Ottawa, Canada, 1890 Report 82.*

"The dewberry has the advantage of being easily protected when protection is necessary, and in some parts of the country it may prove a valuable addition."—*C. B. Waldon, N. Dakota Exp. Sta. Bulletin, 2, 15.*

By reference to page 286, it will be seen that it stands 8 in hardiness at the Indiana experiment station, while Windom stands 4, Early Harvest blackberry 4, and Snyder blackberry 10. In T. T. Lyon's latest report (Bulletin 67, Mich. Exp. Sta. 16) it is ranked 3 in hardiness in a scale of 10.

In our own plantation the canes have not been injured to any extent.

But what is the general value of the Lucretia dewberry? Is it an acquisition? It is impossible to answer this question unreservedly. It seems to me to be a valuable fruit because of its earliness, large size, and attractiveness, and a habit of growth which affords winter protection in the north. The canes are very thorny and this feature, in connection with the low growth, makes the gathering of fruit unpleasant. But a proper system of pruning and mulching will overcome some of this difficulty, and if the canes are tied to a trellis the picking is pleasanter than in blackberries.

The adverse opinions often come from persons who allow the plant to grow at will, a treatment from which we have no reason to expect good results. Cultivation and pruning are as essential in the dewberry as in the blackberry. We must learn how to overcome the failure of the flowers to set, and to prevent formation of nubbins. In my experience, however, the greatest difficulty has arisen from the great variation in the plants, and I suspect that much of the supposed tendency to form nubbins is really a permanent characteristic of some plants which are not true to type. In a plantation of fifty plants, fully half bear worthless fruit, while the remainder bear large and handsome berries. The plants also vary greatly in time of ripening their fruits. The best plants gave ripe fruit this year July eighth, but others gave none until the sixteenth. Whether this variation comes from a sporting in the variety since its introduction, or is chargeable to the substitution of wild or inferior plants by dealers it is impossible to say; but it is a serious drawback to dewberry culture. It is certainly conceivable that wild plants may be substituted for the named variety if the stock should run short, and as early as 1886 I find an intimation that this has actually occurred. The poor plants in our plantation belong to the botanical variety *roribaccus.*

In order to show what success has been obtained in dewberry culture by careful growers, I append various expressions which I have gathered from apparently reliable sources and from an extensive correspondence.

J. T. Macomber, northern Vermont: "The Lucretia dewberry has been spoken against by some but I think it is the most valuable blackberry to plant at the north. It may not be as hardy as some of the bush sorts, but its natural position on the ground makes it one of the easiest of plants to cover. A few evergreen boughs I find to be sufficient. Some complain that the fruit gets covered with dirt during rains, but it is not necessary that it should become dirty. I make a horizontal trellis about two feet from the ground upon which I lay the canes in the spring. This puts them in the best position to be protected from birds by mosquito netting."

J. H. Hale, Connecticut: "They are planted in rows eight to ten feet apart, with plants four or five feet apart in the row, forming a thick matted row or bed four or five feet wide. They throw up fruit spurs a foot or more high, and were just literally loaded with fine large berries as large as the Lawton blackberry at its best, solid, without core, jet black and of the delicious rich spicy flavor of the wild dewberries of memory. Here they were ripening side by side with Gregg raspberries, making the Lucretia of great value for our New England market, for thus far all of the blackberries we have cultivated here ripen late in August, at a time when peaches are coming into market and the buying public are about tired of small fruits. To sum up, after growing the Lucretia here in Connecticut, and after a careful inspection of the fields of it in Ohio, I am convinced that the Lucretia dewberry is a vigorous, healthy plant, as hardy as the Taylor blackberry, as productive as Snyder, as large as the Lawton, and the best in quality of any of the blackberry family, and the earliest of all to ripen. I do not see how it is possible to produce a better fruit of its class."

The best account which I have found of the commercial value of the Lucretia is from the late A. J. Caywood of Ulster county, New York, well known as one of our most critical horticulturists. It is the following:

"Concerning the market value of the Lucretia dewberry, I think that it is one of the most beneficent berry gifts that the country has ever received, from several considerations; and I probably would not have given my opinion, was this noble fruit not being traduced by parties who ought to know more of its good qualities. We planted nearly half an acre three years ago, when the price of plants was high. The next summer after planting, it paid interest on land, paid for the plants, all culture and work

(including stakes and tying up), and a balance remained of $28.00, and this year I had a full crop, the first half of which brought me 24 cents per quart—they were sold in 2 one half-pint cups at six cents each.

"They begin to ripen from a week and a half to two weeks before any other blackberry, excepting the Early Harvest, and here it is fully a week ahead of that. It just completes our time for steady picking from first of June, beginning with strawberries, then red raspberries, Lucretia dewberry, and ending with Minnewaska blackberries, the end of September. Its coming so early fills the gap between red raspberries and standing blackberries.

"The characteristics of this fruit are as follows:—A great bearer, berries 1 inch to 1¼ inches in length; and berries have been measured in one patch, by visitors, 1½ inches in length by ¾ inch in width, which is larger than the heaviest Minnewaska Wilson as grown here. The berries are all perfect, with little, if any, deformity in shape, and sweeter than any other blackberry excepting the wild dewberries. Their solidity warrants their shipment to markets at a greater distance than any other I know of. The picking and marketing is of short duration—about two weeks—nicely lapping on to standing varieties; and it is one of the most beautiful sights that one could imagine, the bushes black with large glossy berries, from the top of a five-foot stake to the ground.

"I plant them as I do red raspberries, four feet apart each way, cultivate both ways until the fore part of June, when the renewals get too long to do so. We then direct the renewals of each row along the bottoms of the hills, and cultivate the other way, as long as required, and one man has done the directing of our patch in a day. The old canes are taken from the stakes any time after the fruit is off, before tying up in the spring. The renewals are left on the ground all winter, which is sufficient protection here, but, if it is necessary to protect them in colder regions, their prostrate position facilitates the work.

"In the spring, one draws the entire hill from under the other hills in the row, and holds them to a stake, while a boy ties them tightly; this can be done as rapidly as tying red raspberries. I think my patch was the first managed on this plan. We have tried the winrow system but like staking the plants better."

A grower in western New York has a small mixed plantation of Lucretia and Mammoth which has given him good results. The plants are grown in a shady and protected spot. Some of the plants were trained over a woven wire trellis, but they were killed back, while those lying upon the ground without protection were not injured.

W. J. Green in Proceedings of the Columbus Horticultural society, 1886, writes: "They are of good size and good quality, and I shall set out enough of them in the spring to supply my family, as they can be protected so easily if necessary and come so early. I had them ripe this year before the late strawberries were gone." Mr. Green in report of the Ohio experiment station for 1886 (p. 192): "Lucretia dewberry sustains its reputation, here and elsewhere, so far as heard from. It is earlier than any blackberry, while the fruit is very large and the plants hardy and productive. The fruit is of good quality when fully ripe, but only moderately good at the time when it should be picked for market. It is a desirable acquisition for this latitude." Mr. Green in Report for 1887 (p. 257): "The Lucretia dewberry, although not of high quality, is valuable because of hardiness, productiveness, earliness, and large showy fruit." Mr. Green in Bulletin 5, Ohio experiment station, 1888 (also in Report for 1888, p. 115): "This uniformly gives a crop of fine large berries, which ripen with Early Harvest or a few days later [earlier]. The berries are difficult to pick and of rather poor quality except when fully ripe and at this stage are too soft for shipment. The above defects detract from its value, but it can still hold a place alongside our best blackberries. It can have but little value in sections where the best varieties of blackberry are hardy, but it is surely deserving of a place on our lists in this latitude."

John Craig in Report of Central Experiment Farm, Ottawa, Canada, 1890 (p 82): "The Lucretia dewberry, a trailing form of the blackberry, has not been productive on light soil, nor has it sustained its reputation for hardiness. From present experience it can not be recommended for other than garden culture."

C. H. Hamilton, Ripon, Wisconsin, before farmers' institute: "I have tried a few hundred plants [of dewberries]. The Lucretia did extremely well, and bore a very good crop of fine berries."

The following discussion took place before the Eastern Iowa Horticultural society at Grinnell, Iowa, December 1 and 2, 1886, upon the occasion of the reading of a paper upon the blackberry and dewberry by J. K. Bloom.

Mr. Fluke—"The Lucretia is an excellent berry. I think it an acquisition. It is hardy and a great bearer. The berries are very large."

Mr. OSBORN—"Mr. Frost has been testing the dewberry. Everyone ought to have some in his garden."

Mr. WILLARD—"The question with me is, whether it should be allowed to run on the ground. I do not believe the berries can be marketable."

Mr. WILLIAMS—"I think the dewberry is rather easy to care for, but the berries are rather soft."

Professor BUDD—"I think the Lucretia is is a success here, more especially if we protect it a little. The dewberry is a native of the northwestern states. There is a dewberry picked up at Sparta, Wisconsin, a really superb berry. It seems hardy and very desirable. There is another brought out in that section which is very much better than the Lucretia. We must look to our own timber lands for a really successful Iowa berry, and I move that we give encouragement to our native blackberry and dewberry."

A. E. GIPSON, Colorado: "The dewberry or running blackberry, is succeeding admirably in certain localities and some kinds of this popular fruit are likely to be found adapted to general culture in the west. It is well worth extended trial."

Experiences from Florida—W. C. STEELE: "I have never found any native variety worth cultivation, but I have grown Lucretia in perfection. It produces the largest berry I have ever seen. On moist lands in Florida it is a success." Discussion before Florida Horticultural society: Mr. WRIGHT—"I have never been able to get any fruit from the Lucretia in Florida. I have never seen even any blossoms on it here. Mr. BACON—I think if you will pile up some timber that you want to decay and plant the dewberries around it, you will get all the fruit you want. I have about an acre of them fixed in this way, and I never before saw such a mass of berries. The ground was so black that you could scarcely see any green. There was probably ashes in the ground, for when the timber was cut everything was burned that would burn. I have also seen them grow on high ground where there was plenty of rotten wood. Mr. MOTT—The ones I ate in Louisiana were twice as large as any blackberries I ever saw, and better than any I ever ate. I believe it is worthy of extensive culture here."

The following are extracts from letters:

E. S. CARMAN, New Jersey, editor *Rural New-Yorker:* "It is desperately thorny and it is more trouble to gather the berries than they are worth. Quality fair. Fruit soft, large. What is the use of it if we can raise blackberries?"

MATTHEW CRAWFORD, Ohio: "When the Lucretia was introduced, I purchased some plants and fruited them. The fruit was good, but the manner of growth is so objectionable that I rooted them out. I soon discovered that a small piece of root a foot under the surface would send up a sprout like a thistle."

M. J. GRAHAM, Adel, Iowa: "I have a dewberry plantation of about 1,000 hills comprised mainly of Bartel and Lucretia, with a few Windom. They are planted between the rows of trees in a young cherry orchard. Tree rows are 20 feet apart—one row of dewberries in the center of space—plants four feet apart in the row. It is my intention to drive stakes (to stand about three feet out of the ground) in the rows, placing the stakes half way between the hills, and then tie the vines up to the stakes at an angle of about 45 degrees. This will keep the fruit clean, and get it up where one can more readily gather it. By thus tying the bearing vines at an angle, the young vines will have more light and room than if old vines are tied straight up to stakes. Would trim fruiting vines back to within one foot of stakes after tying up. In this latitude I think it will pay to cover the vines lightly during winter with coarse litter from stables, etc., as there is some tendency to winter killing, and the rabbits are very destructive to the vines. As the dewberry ripens just before the blackberry, and at a time when the markets are comparatively bare of small fruits, there is little doubt but that it will sell readily at good prices."

J. D. KRUSCHKE, central California: "I am well acquainted with the Lucretia, and find that wherever it prospers it is a great yielder of very large and good berries. It is growing here and produces wonderfully. Its trailing habit renders a mulch necessary in a rainy climate to keep the berries clean. The mulch is not needed here. It ripens with Wilson Jr. blackberry, or perhaps a little earlier."

A. I. ROOT, Ohio: "I have had Lucretia for years, but rarely get a perfect berry. It blossoms full and bears profusely, but the berries are invariably blasted and imperfect."

The Lucretia is the only dewberry which is admitted to the last (1889) fruit catalogue of the American Pomological society. It is given one star—indicating that it is recmended for cultivation—for Massachusetts, Ohio and Iowa, and two stars—denoting "great superiority and value"—for Florida. In the Michigan fruit catalogue for 1888 it is rated 8 for dessert and 7 for market in a scale of 10, and it is said to be "the largest, most productive and best" of the three varieties mentioned, the others being the Bartel and Mammoth.

Our plantation of Lucretia has been seriously attacked by anthracrose (*Glœosporium necator*) and a rust (*Septoria rubi).* The anthracrose or cane rust attacked the plants while the fruit was ripening and caused the loss of nearly half the crop on many plants. It appears as sunken patches upon the canes and red white-centered spots upon the leaves. If the attack is serious the berries shrivel. Cleaning out or burning the leaves and old canes during the winter and applying fungicides early in the spring will probably hold it in check.

From all the foregoing evidence it appears to be safe to say that the Lucretia dewberry possesses desirable features, and that in many places it will be found to be profitable. It needs pruning and other attention, and trellising is often advantageous. It is about as hardy as the common blackberries, but it is easily protected. Its greatest merits are earliness, large size, and ease with which it can be protected from cold. Its greatest demerits are the frequent failure of its flowers to set, the formation of nubbins, its variability, and the labor of picking. It has received commendations from Vermont to Florida and California. It is probable that it will gain in favor as a fruit of secondary importance when the best methods of growing it become better known.

5. Bartel (*Rubus Canadensis* var. *invisus).*—The Bartel enjoys the distinction of being the first dewberry, so far as I know, to receive a name. It was brought to notice some time early in the seventies by Dr. Bartel of Huey, Clinton county, southern Illinois. The story goes that the plants appeared in an old cornfield upon his farm, and some of the berries were so large that he conceived the idea of selling plants. He procured a lithograph of the berries—which did ample justice to the fruit,—described the methods of growing them and for a time disposed of considerable stock. The introducer was an old man at this time and was one of those clever and picturesque individuals who often lend an interest to a neighborhood. The first printed record of this berry appeared in December, 1875, in Purdy's *Fruit Recorder* (p. 182). This is a communication from "T. C. Bartels of Clinton county, Illinois," and is headed "Bartles' Mammoth Dewberry."* The description of the berry runs as follows: "This is a very fine berry, ripening from the last of June until the middle of August. The fruit is very large, rich and juicy, slightly acid, but not so sour as the blackberry. When ripe it is black, and is sufficiently solid to bear shipment with safety. I have had berries over two inches in length and one inch in diameter. They are a perpetual bearer, from the time they begin to ripen (in ordinary seasons) until the last of August—having blossoms on the same vine simultaneously with the ripe fruit. They are very prolific, yielding in a fair season from sixty to eighty bushels to an acre. They do not blossom until late in the spring—later than the strawberry—the fruit maturing in from four to six weeks after blossoming—hence they are seldom if ever injured by late frosts in the spring. They are very hardy—having succeeded so far north as Wisconsin and the northern part of Iowa." An account of methods of cultivation is then given. "I shipped some of my dewberries to New York city from this place for which I received sixteen dollars per bushel. I also shipped to Rockford, Ill., St. Louis, Mo., and to Independence, Iowa, for which I received twelve dollars and eighty cents per bushel; while the highest price paid for strawberries did not exceed, on an average, six dollars and forty cents per bushel. I consider the dewberry the most profitable fruit raised." Mr. Purdy gave roots of this dewberry as a premium to his paper at this time, and among those who obtained it were I. N. Stone of Fort Atkinson, Wisconsin, and Hon, B. F. Adams of Madison, Wis., the only persons, probably, as Mr. Stone writes me, "who had sufficient confidence in it to give it a fair trial." Mr. Stone has made a marked success of its culture, and all the plants set in recent years appear to have come directly or indirectly from him.

A good account of the Bartel was published in *Garden and Forest* recently by Professor Goff. "In the summer of 1889," Professor Goff writes, "I saw a small plantation of Bartel on the grounds of Mr. H. C. Adams of Madison, Wisconsin, that at once established my faith in the possibilities of this fruit [dewberry]. I was informed that the most productive season had passed at the time of my visit, and that the ber-

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*The name of this dewberry is variously written Bartle, Bartles', Bartell and Bartells', but I have the evidence of a neighbor of the introducer, who is now dead, that he spelled his name Bartel. Perhaps the orthography of the name may have been confused because of another family in Clinton county which spells its name Bartels.

ries which I saw were inferior in size to those gathered a few days earlier. But at this time the vines were fairly well loaded with fruit of larger size and more attractive appearance then the finest blackberries, and, to my taste, altogether superior in quality. There is a juicy, melting quality in the dewberry that is scarcely equaled by any other fruit of my acquaintance. The fact that the dewberry is prostrate in its habit of growth is a decided objection to it in climates where winter protection is unnecessary. But in regions of severe winters the ease with which the plants may be covered is a partial recompense for this fault. It is said that a plantation once started is eradicated from the soil with considerable difficulty, which, if true, is an additional objection to the plant in cultivation. I consider Bartel dewberry worthy of trial by all who are interested in testing new fruits. Mr. ADAMS, who is an extensive grower of blackberries, has found this variety more profitable as a market fruit than any blackberries he has grown."

Mr. ADAMS writes me as follows concerning his management of the Bartel: "I have tried no other variety and have given it what I call rather slack cultivation, never having covered it in winter or trellised it. Our theories generally outrun our practice. This is my notion about the culture of this fruit: The plants should be set 3x7 feet on good, rich land. Laterals should be pinched at 2½ feet, and all but six of them cut out entirely. They should be covered with earth two inches in winter. They should not be trellised, as the fruit needs the dense shade of heavy foliage to perfect it in size and flavor. It is the most saleable fruit that goes into market. The plants do not bear to amount to anything for the first three years."

The fruit list of the Wisconsin Horticultural society for 1891 recommends the Bartel for trial "on clay soils." And this list is the only instance which I know of the correct spelling of the name of the variety.

Mr. STONE, now of Sioux City, Iowa, writes me the following experience: "I will say positively, after twenty-five years' experience in growing small fruits for market, that I know of no kind of small fruit which will pay so well as the Bartel dewberry; and especially is this true throughout the northwest prairie country, as it can be so easily protected from the dry winter winds. The Bartel will produce well from the same hill fifteen years in succession with proper care, and it will increase in productiveness for the first eight years. Many lose faith in it, as well as in other varieties, because it does not give more fruit the first year or two. I am sure that two hundred bushels of fruit can be grown on an acre of six or seven-year-old plants. I am now picking from hills on my grounds which will yield four quarts per hill and only four years old. Another good point is that its fruiting season is long and comes at a time when there is scarcely anything in the market to compete with it. I have the Lucretia by the side of the Bartel, same age and same cultivation, and have had them so situated for years, and during this time the Bartel has given double the amount of fruit. I also have the Windom; it lacks both size and quality. The Bartel has scarcely any thorns as compared with the Lucretia, making it easier to pick from; still I would not discard the Lucretia, but prefer the Bartel by one half. You ask if any of the dewberries are destined to become market fruits. I will answer by saying that I firmly believe that within ten years no small fruit garden will be complete without a good supply of them."

Mr. STONE's advice for the management of dewberries, especially of Bartel, is this: "Dewberries should be transplanted in early spring, setting one or two-year-old tips only. Plant 3½ by 5 feet, and cultivate shallow one way only, with a horse, using a hoe between the plants in the row. The first year we can cultivate close to the row regardless of canes, as the cultivator will turn them without injury, so they will grow alongside of the row. After the first year the canes should be cut back to about two feet when 2½ or 3 feet in length. It will be necessary to go over the vines several times during the growing season in order to prune the earlier and the later canes at the proper length. All varieties need winter protection in a cold climate, to insure a good crop every year. Just before the ground freezes the canes should be placed along the rows, then covered an inch or two deep with mellow soil, and before severe winter weather sets in cover the whole surface with mulching, using more over the rows than between them. In the spring, work the canes up through the mulching with a fork, and move the mulch from between the rows, placing it along the row and under the canes, leaving the plantation so it can be cultivated one way only. The canes may be tied to a trellis or racked by driving stakes on each side of the row, so they will be about two feet high; then attach a wire to the stakes on each side of the row, so they will be at the proper height to allow the canes to rest upon them; if the wires are placed at the right height the canes will not need tying. It will pay to use mulching under the bushes, even where it is not necessary for winter protection, as it will keep the fruit clean, and render the soil fertile and moist."

C. G. CARPENTER, Nebraska, writes me that the variety "does fairly well; in fact I

think as much of it as I do of Lucretia. The berry is fully as large as the Lucretia, and much better in flavor. The plants seem to be deficient in pollen, and I think it would be a benefit if other varieties of dewberry were planted with them."

The Bartel appears to have found little favor with most growers. Nearly all the favorable testimony comes from the west. It has been grown for some years at the New York state experiment station at Geneva. The record of the dates of blooming and fruiting show that it does not differ perceptibly from Lucretia in those features. The plants have always been unsatisfactory there, so much so that the report of the station for 1888 records that they "were removed, in consequence of which they have not been reported on." Yet the variety is still growing at Geneva, and Mr. Hunn, horticulturist, reports that in 1890 it "gave considerable fruit, but of poor quality and extremely difficult to harvest. I am of the opinion that they are of but little value grown as running plants, but if grown on a trellis they are more fruitful and of better flavor, as the sun would have a tendency to make them sweeter." Professor Goff records that at Geneva "the plants were quite unproductive and the fruits filled out very poorly." T. T. Lyon makes the following record of it in a "report on new fruits" in 1883: "Bartel is a variety received from Nebraska, having the trailing and tip-rooting habit of this class; very unproductive. Fruit small, round, black; pips very large and prominent; texture medium, juicy, mild, sub-acid. Judging by its performance so far, it is but a cumberer of the ground. Ripe July 28th." In the Michigan fruit catalogue for 1888 the Bartel is ranked 5 for desert and 2 for market, and it is characterized as "an uncertain bearer, fruit often small." E. Y. Teas, Irvington, Indiana, writes that he has cultivated it many years: "It has always been valueless with me, and many other cultivators have discarded it as worthless. It must be a variable variety, for others consider it equal to the best. I never obtained a perfect berry."

The failure of the Bartel to bear was ascribed by Mr. Purdy to imperfect or unisexual blossoms, but all dewberries which I have seen have perfect or two-sexed flowers.

It is evident that the Bartel has merits, particularly for the west. It needs more extended trial in the east to determine its value here, but the evidence thus far is not encouraging.

6. Mammoth.—There are certainly two plants sold under this name, one being *Rubus Canadensis* var. *invisus* and the other apparently true *Rubus Canadensis*. The former is, I think, the same as Bartel, but the history and characteristics of the latter I have been unable to trace.

So far as I can learn, the commoner Mammoth dewberry offered by nurserymen is simply the Bartel, and the plants which I have grown and seen of it appear to be the same. The original name of the Bartel was Bartel's Mammoth, and it is now often sold under this name; and sometimes Bartel is omitted. I have written to nurserymen who advertise the Mammoth, and all the replies which I have received state that Bartel, Bartel's Mammoth, and Mammoth are the same. It is a common impression among growers and experimenters, however, that the two are distinct, perhaps because they were received under different names. Mr. Lyon in the Michigan report of new fruits in 1883, quoted above, says that the "Mammoth is another variety of similar character [to Bartel] scarcely more productive. Ripe August 1st." Separate reports of Bartel and Mammoth are given by the New York state experiment station, and Professor Goff speaks of them as different in his articles already quoted. But no one, so far as I can learn, has pointed out any differences between the two.

One of the replies to my inquiries of nurserymen, from a very prominent western firm is as follows: "As to Mammoth, we verily believe there is in reality no specific variety generally distributed and known under this name. Twenty years ago, Dewey, the plate-maker, had a plate called 'Mammoth Prolific Dewberry,' and so long ago as 1873, we scoured the country over trying to find a few hundred of something by this name for a customer who had sold them from the aforesaid plate, but could not learn of anything of the kind then in existence. Since the introduction of Lucretia, a firm in Jackson county, Illinois, brought out a variety they called Mammoth, and while we are not absolutely sure, we think it was merely a wild variety which they took up, propagated, and gave this name. We obtained plants and have had them in cultivation for a number of years; do not know but that they have done about as well as Lucretia, though we must say that none of the dewberries have been particularly satisfactory with us."

I mistrust that the plate referred to is the one which Dr. Bartel had made for his variety. I have been unable to learn the history of the plate. It seems to have made no impression upon the nurserymen of western New York, where Dewey, the plate maker lived, and I have not been able to find a copy of it. I feel sure that the common Mammoth is the Bartel.

The other Mammoth is the one referred to in the letter above quoted as coming from a firm in Jackson county, Illinois. I understand this firm to be BAILEY and HANFORD, which is now dissolved. I have been unable to get any direct statement of the variety. I have received the plant from a party who obtained it indirectly from BAILEY and HANFORD, and it is distinct from Bartel, for it belongs, apparently, to the type form of *Rubus Canadensis.* I know nothing yet of the value of this Mammoth, but it is certain that it has not yet become generally known.

In regard to this confusion, Mr. STONE writes me as follows: "The Bartel was introduced as Bartel Mammoth and is generally known by this name now, but the name Mammoth has been dropped by some on account of there having been an entirely worthless variety called Mammoth sent out quite extensively. It is for this reason that I have dropped Mammoth. The variety sent out under the name had a much larger cane and blossomed freely but never set any fruit; at least this was the case with the stock I had."

7. GENERAL GRANT (*Rubus Canadensis* var. *invisus*).—This variety was introduced by CHARLES A. GREEN of Rochester, N. Y., in 1885 or 1886, as a premium to his *Fruit Grower*. It came from M. W. BROYLES, somewhere in Tennessee. Mr. GREEN informs me that the variety did not prove to be as valuable as represented to him, and he therefore dropped it. I first grew the variety in 1886, and it seems to possess little value. The variety has never become prominent.

8. NEVER FAIL (*Rubus Canadensis* var *invisus*).—I know this only from a specimen and notes sent me by F. L. WRIGHT, Plainfield, Mich., who obtained it from some person in central Indiana. He says: "It never fails to produce an abundance of wood, but always fails to produce fruit. I never had a perfect berry." It is said to have originated in central Ohio.

9. FAIRFAX (*Rubus trivialis?*).—I first heard of this variety from E. S. CARMAN, editor of the *Rural New Yorker*. He tells me that he received it from the introducer in the spring of 1884, but it was valueless with him. It was sent out by C. A. UBER of Fairfax county, Virginia, now of Virginia Beach, Va. Mr. UBER writes as follows: "I found it growing wild in Fairfax county, Va., on a hillside of a stony, unproductive field. I watched it carefully two seasons and it was a very large, fine-flavored berry growing on a vigorous but not rampant vine. As it seemed so desirable in every respect, I carefully removed all other vines from its vicinity during the second year and rooted plants from it which I planted in very rich, rather moist, but by no means wet soil; and such vines you never saw, but the berries did not seem to have time to grow! Instead of a perfect collection of juicy drupes there were but few and they not of the best, although the vines were contiguous to my experimental patch of 14 varieties of blackberry and pollen should not have been lacking. I sent some also to a friend in Texas and one in Missouri, and I believe one in Ohio, but it did not in either case prove worthy of cultivation."

10. MANATEE (*Rubus trivialis*).—This variety was introduced by REASONER Brothers, Manatee, Florida, in 1889. Their catalogue for 1890 speaks of it as follows: "*Rubus trivialis.* Southern Dewberries. We have an excellent strain superior for this climate to Lucretia, which we have named 'Manatee.' In cultivation this produces fruit at the rate of two hundred and fifty bushels per acre. As it ripens during April it is valuable for shipping, which it stands well." REASONER Bros. write as follows concerning it: "We are growing the *Rubus trivialis* as well as all of our neighbors, who do not have plenty of wild fruiting vines, and consider it as good as any blackberry or better. No other dewberry does well here." And again: "There are no dewberries of value here in this warm climate except this variety; we have tried several sorts but they all die lingering deaths. Lucretia held out the longest, and bore a few berries but they proved very sour and watery, unlike what they should have been. This Manatee is only a selected strain of the common *Rubus trivialis.*"

I once grew the Manatee but it was killed the first Winter. J. E. CUTTER of Riverside, California, says that the variety succeeds with him.

11. BAUER (*Rubus trivialis*).—The first published record of this was made in the *American Garden* last February (p. 84), in a brief note from C. E. HUNN, horticulturist of the New York experiment station at Geneva. He had not fruited it. This variety came from BAUER's nursery, Judsonia, Arkansas. Mr. BAUER writes as follows: "The dewberry, we fear, has the grave fault of being unproductive, perhaps because of insufficient pollen. Its cane growth and vigorous appearance are marvelous. The fruit is fine. We are not introducing it, but only gave some away (last year) as premiums on plant orders."

12. WILSON'S WHITE (*Rubus trivialis*).—This was introduced in 1890 by SAMUEL WILSON, Mechanicsville, Penn. Mr. WILSON sends me this account of it: "The white dewberry that we catalogued last year is a native of Texas. The plant was first found growing in Colorado county, that state. It was recommended to us by one of our customers living in said county. We had a few plants sent us for trial and found them all our friend recommended them to be. They are entirely hardy, and in our climate of large size, enormously productive, and excellent quality. For eating out of the hand or for cooking purposes we like them better than any other kind, either wild or cultivated." The account in WILSON'S 1891 catalogue runs as follows: "It is an entirely distinct variety and differs from all other dewberries in the shape and appearance of the leaf, which is smaller, more finely cut, and of the most lustrous shining green color. But the greatest peculiarity is in its great productiveness, large size, and extra fine quality of the fruit. The originator claims that the new White dewberry will produce three times as much as any other kind and of better quality. The vine is a strong, vigorous grower, the berries set thickly on the vine, ripen medium early, and are sweet and delicious to eat from the hand, being entirely free from any hard core or excessive acid taste. For culinary purposes, they are far superior to any of the black varieties, and have the desirable advantage of being picked and eaten without leaving any dark or unpleasant stain on the fingers or mouth."

This variety has not yet been fruited by experiment stations and growers, and its general value is therefore unknown.

The wild *Rubus trivialis* is abundant in Texas, as in other parts of the south, and it appears to be variable. G. ONDERDONK of Nursery, Texas, makes the following statements in his last fruit report and catalogue (1891): "Texas is the most natural home of the dewberry. We consider them better than any blackberry we ever knew. We have both white and black varieties (for sale)." A white dewberry from Texas is mentioned in the *Gardener's Monthly* in 1877.

SUMMARY OF THE EVIDENCE.

1. The cultivated dewberries represent two distinct species of rubus or bramble, and two well marked botanical varieties. It is therefore reasonable to expect that different managements may be required in the different classes, or at least that various results will be obtained from their cultivation.

2. The botanical types to which the cultivated dewberries belong are these:

   1. The northern dewberry or *Rubus Canadensis*. To this type belong the Windom, Lucretia's Sister, and Geer.
      (a) The Lucretia sub-type, or variety *roribaccus*, comprising the Lucretia.
      (b) The Bartel sub-type, or var. *invisus*. To this belong Bartel or Mammoth, General Grant, and Never Fail.
   2. Southern dewberry, or *Rubus trivialis*. Here belong Fairfax, Manatee, Bauer and Wilson's White.

3. The dewberries are distinguished from the blackberries by a true trailing habit, cymose and few-flowered infloresence, and the habit of propagating by means of "tips." Like the blackberries and raspberries, they bear their fruit upon canes of last year's growth, and these canes die or become weak after they have fruited. They are propagated by means of "tips" and root cuttings.

4. The peculiar merits of the dewberries as cultivated fruits are earliness, large size, and attractive appearance, and the ease with which they can be protected in winter.

NOTE—Since this paper was written, roots of two new dewberries—Skagit Chief and Belle of Washington—have been received from Avon, Washington. The varieties are not yet introduced, and I do not know their botanical features.

5. The peculiar demerits of the dewberries are the failure of the flowers to set, the formation of nubbins, and the difficulty of picking the fruit. There is no positive method known by which the first two difficulties can be overcome, and the causes of them are unknown, but there is reason to believe that pruning and thinning of the canes will tend to make the plant productive. The labor and unpleasantness of picking may be avoided by training the plants on a rack or trellis and by keeping them well pruned.

6. Various methods of training and cultivation are advised, but the plants are generally set at about the same distance as blackberries (3x7 or 4x7) and the canes are allowed to lie upon the ground, being headed in when they reach about three feet in length. A mulch of straw beneath the canes keeps the berries clean and renders picking pleasanter. A wire trellis like a grape trellis, or various styles of racks, may be used upon which to tie the fruiting canes, and for amateur cultivation, at least, some such upright training seems to be advisable. Only four to six fruiting canes should be allowed to the plant. Some varieties, particularly Windom and Bartel, appear to do best if the fruit is shaded.

7. Twelve varieties of dewberry have been named and more or less disseminated during the last twenty years. Of these, four (omitting the Mammoth) have gained more less prominence, and are found to possess decided merits in certain places. This is a fair proportion of good varieties to inferior ones, as indicated by the annals of other fruits.

8. Many persons have found dewberry culture to be profitable. This is evidence that the fruit is an acquisition. But it has not yet found general favor, and it is probable that it will never become as popular as the blackberry. The varieties which enjoy most prominence are Windom, Lucretia, Bartel, and Manatee.

9. The Windom possesses promise for the northwest, of which it is a native. It has not yet been tested to any extent elsewhere. It appears to demand partial shade for the best success.

10. The Lucretia has been found to be a desirable and profitable fruit in many places over a large extent of territory, and it is therefore safe to conclude that its range of adaptation is large. Many, however, have failed with it. It appears to be variable and many of the plants are worthless. It is seriously attacked by anthracnose and by a bramble rust.

11. Bartel has found great favor with some growers in the west, from Wisconsin to Nebraska. It has not succeeded well in the east so far. Some of the variety known as Mammoth appears to be identical with Bartel.

12. Manatee is probably valuable for the south, and it appears to be the most useful form of *Rubus trivialis* yet tested.

L. H. BAILEY.

BLACK KNOT OF PLUM AND CHERRY.

Plowrightia Morbosa, (Schu.) Sacc.

"Black-knot" is a disease of plums and cherries which causes the formation of a hard, rough, black wart-like surface on an enlarged or distorted outgrowth of the bark. It is not a new disease. Its pernicious character has long been known. Nearly five years ago Mr. A. J. DOWNING said of it that "in some parts of the country it is a most troublesome disease and has even destroyed the whole race of plum trees in neighborhoods where it has been suffered to take its course." Could he have looked into the future and seen the plum industry literally wiped out of existence by black-knot not only "in whole neighborhoods" but in whole counties along the famous Hudson river valley, doubtless the strong words quoted above would have seemed to him a faint statement of the destructive character of this disease. Although DOWNING did not know the real cause of the trouble yet he urged upon his readers the proper remedy, namely, the destruction of all affected parts by fire; but he advocated burning as early as possible in the spring, while, as will be shown hereafter, the proper time is just after the leaves fall. He also gave the following sound advice: "It will be necessary to prevail on your neighbors, if they are near ones, to enter into this plan, or your labors will be of little value." Had his advice been followed and the work of burning all black-knot wherever found been systematically undertaken at that time and enforced by wise laws supported by strong public sentiment in their favor, there is little reason to doubt that in the favored localities along the Hudson river commercial plum orchards might have been paying good profits for the last twenty years instead of presenting as they do discouraging pictures of loss and decay.

A reliable nurseryman recently made the statement that "Twenty years ago there were shipped from Geneva to the Hudson river country from twenty thousand to twenty-five thousand plum trees annually, where now few or none are sent and the reason for this loss to the nursery trade is fully accounted for by the fact that the black-knot has become so destructive that no one dares to invest his money in plum-growing in that section."

The following brief accounts of destruction of plum trees by the black-knot are sufficient in themselves to show that this disease must be placed on the list of serious public pests and like the glanders or pleuro-pneumonia is a fit subject for special legislation designed for its eradication or control.

Mr. GEO. T. POWELL of Ghent, Columbia county, New York, who is director of the department of farmers' institutes of the New York State Agricultural society, writes as follows:

"The black-knot has swept the plum-growing interest nearly out of existence in the Hudson river valley. When the orchards were being cut down and planting had ceased I put out an orchard of one thousand trees

and for seven years I successfully kept it off. Each year there would be some formation but we very persistently kept it off. Last spring there was none to be seen on my trees when they were in bloom having taken every particle off very closely. On the first of September every portion of the trees was completely covered and the entire tops of all trees will have to come off.

So great was the attack that when I discovered it I had to abandon all efforts to take it off. Even the twigs upon which the fruit had set were so enlarged by the knot that the fruit on them was deformed.

We had had three wet seasons previous to 1891, and while 1891 was quite dry, the conditions had been favorable for a great development of the fungus and the attack exceeded anything I had ever known. There were old trees adjoining my farm from which I think the trouble was spread over my orchard. My orchard is highly cultivated and fertilized but I notice that uncared for trees were as badly affected in this locality as mine were."

The following statements kindly furnished me by Mr. P. Groom Brandow of Athens, Green county, New York, indicate the former extent and value of the plum industry in that region and its total devastation by the black-knot.

He states that, beginning at Cedar Hill about four miles below Albany, the plum district included a belt about three miles on each side of the river, and extended southward about thirty-six miles to Germantown. He began setting plums for a commercial orchard in 1861 and at one time had 6,000 trees. Two of his neighbors each had about two thousand trees, and most of the farmers went into the business to a greater or less extent.

It was no uncommon thing for a steamer to carry from one hundred to five hundred barrels of plums to New York at one trip. For four days' picking in one week he received $1,980. In 1884 he netted $8,000 from his plums, and the next year he rooted out over five thousand trees on account of black knot. From twenty-five hundred young trees two or three years old, left at that time, he thinks he has not yet realized over $250.

One instance is cited of a young orchard set within a few hundred yards of an old orchard that had been destroyed by the black-knot, and within two years the young orchard had to be rooted out on account of the same disease.

Mr. Brandow further says that he knows of but one man who has set any plums within the last six years, and this orchard is a failure. The knot became the most destructive about 1869, and has continued its ravages till the whole plum industry in this region is practically wiped out of existence by it.

Mr. Brandow is in his seventy-fourth year. His whole life has been spent on the old homestead, and as far back as he can remember the knot has infested their plum and cherry; but when the trees were ruined they were pulled out and new ones set again. He thinks that at least four times in his remembrance he has seen these epidemics of black-knot come and go.

When the disease began to attack his trees about the year 1870 he commenced cutting out the knot and continued the warfare twelve or fourteen years, and believes that he could have controlled it but for his neighbors' trees which were infested with the disease. As it was, his orchard was the last to go down. He says he did not practice burning the knots, but

now thinks this was a great mistake. He would not advise any one to set trees in a locality where there are old plum or cherry trees covered with black-knot.

At a meeting of the Western New York Horticultural society held in Rochester, January 27, 1892, the following resolutions were unanimously adopted:

WHEREAS, The interest we here represent involves expenditure and a large outlay of capital for years before any adequate returns are received; and

WHEREAS, The risks attending the growing of fruit from the depredations of insect life and fungoid diseases are so rapidly on the increase as to be a source of the greatest anxiety and alarm to all engaged in the business; and

WHEREAS, At this time there is great reason to fear that the total extermination of the plum and cherry orchards of the state may follow the rapid spread of one of these diseases, which science has demonstrated may be arrested in its destructive work by the enforcement of a proper law, such as has already been enacted for stamping out the disease in peach trees known as the peach yellows; now, therefore

Resolved, That it is the unanimous sense of the fruitgrowers in this meeting assembled, that it is of vital importance to them, and their interests demand that the legislature of this state shall, without delay, enact such a law as shall, in its enforcement and execution, thoroughly and effectually exterminate that infectious and incurable disease known as black-knot.

Mr. S. D. WILLARD of Geneva was appointed a committee to draft such a law and present it to the legislature. At the present writing the law has been introduced into the legislature and will undoubtedly be passed.

It is believed therefore that a bulletin giving the life history of the fungus which causes black-knot, although the facts presented are not new to science, will be especially valuable at the present time because there are yet many persons interested in plum culture who do not realize the very dangerous and destructive character of the disease and who have no definite idea of its cause and the means by which it rapidly spreads from tree to tree.

A more general understanding of the reasonableness of the legislation referred to and of the importance of vigorously following its provisions will undoubtedly insure the hearty support and thorough enforcement of this law.

CAUSE OF THE DISEASE.

It was formerly believed that black-knot was produced by some gall insect, and it is not strange that this opinion prevailed on account of the gall-like character of the knots and the fact that they are frequently infested by insects. Some believe it to be the work of the curculio, others thought that it was not the curculio, but some other insect or cause that produced the knots. But several years ago Dr. FARLOW published in the First Annual Report of the Bussey Institute the results of his investigations which proved conclusively that black-knot is caused solely by a parasitic fungus which grows within the bark and which is now known to science by the name of *Plowrightia morbosa.*

It is recognized as growing on cultivated cherries and also on the wild red or yellow plum (*Prunus Americana*), the Chicasaw plum (*P. Chicasa*), the choke-cherry (*P. Virginiana*), the wild red cherry (*P. Pennsylvanica*), and the wild black cherry (*P. serotina*).

It is commonly most destructive to the plum but also seriously attacks

the cherry. DE SCHWEINITZ mentions an epidemic of black-knot which destroyed the cherry trees at Bethlehem, Pa., in 1790, and in various parts of the country to-day the disease seems to be almost, if not quite, as bad on cherry as on plum.

EXTERNAL CHARACTERS.

The external appearance of the mature form of black-knot is generally well known. It appears at this stage as a rough, wart-like excrescence or distorted outgrowth from the bark of twigs and branches and in severe cases may extend along the trunk for several feet.

The fungus may appear on any part of the tree above ground and no portion of either trunk or branches is exempt from its attacks.

BOTANICAL CHARACTERS.

The first outward sign of the formation of a new knot is seen in a swelling of the tissue within the bark either in the fall or during the growing season of the tree. The swelling increases till the bark is ruptured over the surface, and thus exposed the fungus sends out numerous threads (hyphæ) which produce a velvety appearance and are of an olive green color. Microscopic examination of the velvety surface reveals multitudes of newly formed and forming spores borne on these upright threads.

These spores (conidia) are called summer spores. When full grown they drop off from the supporting threads, and when carried by winds, insects, or other agencies, to another host plant, under favorable conditions they may start growth and form a new center of disease from which in time other trees may also be infested and thus spread the disease from tree to tree and neighborhood to neighborhood.

The wonderful provisions for the reproduction of its kind are not ended by growing a crop of summer spores. After a time the production of summer spores ceases, the velvety threads die away and the surface of the knot becomes hardened and gradually changes in color to dark brown and finally to black.

Late in the fall the surface of the knot appears to be covered with pimples visible to the naked eye. These pimples are the outside covering of a tiny spherical case which may be called a spore case (perithecium). A slice across the pimple surface with a sharp knife or razor will frequently show the white contents of the spore case visible to the naked eye.

The oatside rows of cells form the black, hard covering of the spore-case just referred to, making a hollow sphere within which are developed the winter spores. These winter spores ripen inside of long, colorless sacs (asci), and each sac when matured contains eight spores (ascospores). A miscroscopic examination of one of these spore-cases in the fall, discloses the fact that the winter spores are not yet formed.

It has been found that they do not develop till winter and that they become mature and are capable of germination in February or March. The spore-sacs rise from a mass of threads which line the inner walls of the spore case; mingled with the projecting spore-sacs are numerous sterile threads which do not bear spores. Eventually the spore-sacs break away and the spores which they have borne escape from the spore-case and are carried by the winds or other agencies to infect new localities or other parts of the tree on which they have developed.

When the spores begin growth they send a germinating thread from each end. Under favorable conditions these threads grow quite rapidly and the interlacing branches form a perfect mat of threads (mycelium). When growing within the bark of the plum or cherry trees these threads absorb their nourishment from the surrounding tissue and produce in succession the swelling and rupture of the bark, the formation of summer spores, the development of black-knot; and lastly, within the knot are formed myriads of the winter spores.

Both summer and winter spores are produced in great numbers, really in incalculable numbers, and by their agency the disease assumes an infectious character and spreads from tree to tree and from community to community. The fungus is perennial and, having once gained lodgment in a tree, continues to form new knots and to develop the succession of summer and winter spores year after year.

REMEDIES.

Is it not plain, therefore, that the best way to deal with thoroughly infested trees is to cut them down and burn them at once, thus insuring the destruction of the spores before they spread the disease any further? Trees not badly infested may be treated by cutting off affected branches some distance below the knot. This operation is best performed in the fall immediately after the foliage drops, because the winter spores are not formed at that time and consequently there is less danger of their being disseminated in the operation and also because the work can be done more thoroughly when there are no leaves to hide the knot.

The summer spores must also be taken care of in their season. As soon as there are any indications of the formation of a new knot in the spring or during the summer the branch on which it occurs should be cut and burned. The first outbreak will probably be noticed about the middle of May.

It is important to note that if a branch containing the knot be cut from the tree and thrown on the ground the spores will ripen in due time just the same. Therefore, the practice of collecting carefully and burning every knot can not be too strongly urged.

The bulletins of the Massachusetts experiment station contain reports of some experiments in the application of various substances for the purpose of destroying the knot. Kerosene, turpentine, linseed oil, sulphate of copper, and a mixture of red oxide of iron and linseed are mentioned as among the substances tried. These seem to be effective in destroying warts to which they are applied to saturation but care must be used with the turpentine and kerosene or the entire branch will be killed.

Concerted action on the part of all who are interested in growing plum and cherry trees can do much toward eradicating black-knot. For those cases that can not be reached by other means it would seem right that proper legislative enactment be provided so that the fruitgrower may protect his orchard from all infected trees of the vicinity. Let it be remembered that in the work of thorough eradication of the disease the wild plum and cherry trees before mentioned as host-plants of black-knot must not be neglected.

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BULLETINS OF THE U. S. DEPARTMENT OF AGRICULTURE.

THE CHEMISTRY OF PEACH YELLOWS.

BY ERWIN F. SMITH, SC. D., WASHINGTON, D. C.

[Reprinted from the Proceedings of the American Pomological Society for 1891.]

Two years ago, at the Ocala meeting, a paper on this subject was read by title, and published in the proceedings of this society. Since then, some new light has been shed on the peach yellows problem. This, therefore, seems a fitting occasion for supplementing what was written at that time.

Those who are familiar with the question will remember that some of the earlier analyses indicated a diminished quantity of K_2O, and P_2O_5, in peach branches diseased by yellows. It was only a step, albeit a rather long one, from this fact, or supposed fact, to the conclusion, that a deficiency or absence of these substances in the orchard soil was a leading cause, if not the only cause, of this disease. Following these analyses, and based upon this theory, came a series of feeding experiments, by Dr. Charles A. Goessman, then chemist of the Massachusetts Agricultural college, and now director of the state experiment station, assisted by Professor S. T. Maynard of the same school. These experiments were repeated and extended by Professor D. P. Penhallow at the Houghton Farm experiment station in New York. In both series of experiments the endeavor was to add to the soil the substances supposed to be absent or deficient, particularly K_2O and P_2O_5, thus curing the affected trees, and preventing the further progress of the disease.

The published statements from Amherst and Houghton Farm agreed substantially and lead the public to believe that the end had been accomplished, and that liberal doses of muriate of potash and superphosphates, with slight addition of other substances, such as kieserite, supposed to render the muriate more effective, were all that was required to cure peach pellows and to keep the orchards in a healthy condition. These statements were copied widely by the agricultural papers and received the endorsement of several writers on horticulture, particularly A. S. Fuller, J. H. Hale, and Eli Minch.

These views were vigorously combatted by practical men equally eminent in horticultural science, and the war of words ran high. The horticultural

tomahawk was brandished vigorously, and woe to luckless wight who fell under its blows. Mr. Minch even went so far as to say, "I deem the man who contends that yellows is a contagious disease a dangerous character," while Mr. Fuller declared with equal emphasis: "The doctrine that yellows is not contagious is a dangerous one to teach."

Such was, substantially, the state of the question when the peach yellows investigation was taken up by the department of agriculture.

Dr. Goessman began his researches in 1876, and the special treatment of diseased peach trees in 1878. His analyses with comments were published in "The Transactions of the Massachusetts Horticultural Society" in 1882. He first treated "slightly affected trees with a phosphatic fertilizer in the usual proportion, adding at the same time from three to four pounds of chloride of potassium (muriate of potash) for every tree." Finally he settled upon a mixture of bone-superphosphate, muriate of potash, and sulphate of magnesia, laying special stress on the "specific action" of muriate of potash. Concerning these treatments he remarks, in 1889: "Our own observations have been most encouraging, and satisfactory results are reported from all directions."

Professor Penhallow's first paper was published in 1882, in connection with Dr. Goessman's; and his experiments at Houghton Farm, subsequently described in two bulletins from that station, were begun the same year and concluded in 1883.

In his later writings he advised 625 lbs per acre of the following mixture:

Kieserite	25 lbs
Muriate of potash	150
Dissolved bone black	450

If marked evidence of the disease was present he recommended an additional 4 lbs of muriate for each affected tree, and said: "If not too far gone, two or three years will probably complete the cure, but careful treatment will be needed afterward to prevent return."

Professor S. T. Maynard, who carried on most of the field work at Amherst, recommended in 1884, "400 lbs of acid bone phosphate, 150 to 200 lbs of muriate of potash, and 100 lbs of crude sulphate of magnesia," as the mixture which they had found to give the best results. This he said should be applied in the fall or very early in the spring, and worked into the soil around the trees.

Concerning the contagious nature of yellows Professor Penhallow wrote in 1884: "In my first report for 1882 I ignore contagion in this disease, and have still no reason for believing in it." In 1884 Professor Maynard also wrote: "While I have no positive proof that the disease is not contagious, I do seriously doubt if *anyone* has *positive* proof that it is."

Dr. Goessman now seems to hold a middle ground, believing that whatever be the cause of yellows, we can enable peach trees to resist it by giving them a sufficient quantity of food. Probably the best way to present this subject succinctly will be to divide it into two parts, first treating of laboratory work and then of field work.

CHEMICAL ANALYSIS.

When my attention was first called to this theory of peach yellows, it struck me that the evidence was rather meager, and not as harmonious as

we are accustomed to require for biological work, and the more the problem was studied the more this fact stood out. Very few analyses of the peach had been made, and these did not fully agree. Additional analyses were made at my request, and the conclusions from three of these are here presented for the first time. Not to be tedious I shall give a comparative statement, asking your attention only to certain striking discrepancies Those who are specially interested will find the omitted details elsewhere.

According to the following authorities, peach branches when diseased by yellows vary from healthy ones, as follows, omitting minor differences:

TABLE I.—*Showing the principal differences between healthy peach branches and those affected by yellows, as determined by five chemists (14 analyses).*

Authority.	Diseased Branches Contain		
	Lime (CaO)	Potash (K_2O)	Phosphoric acid (P_2O_5)
Kedzie (1872)	Slightly *more*	Much *less*	Slightly *less*
Goessman (1882)	Much *more*	Much *less*	Considerably *less*
Conn. Experiment Station (1884)	About *same*	Much *less*	Slightly *more*
A. E. Knorr (1888, Green's orchard)	Much *less*	Much *more*	Much *more*
J. F. Eastwood (1890, Green's orchard)	Much *less*	Much *more*	Slightly *less*
J. F. Eastwood (1890, Harper's orchard)	Much *less*	About *same*	Much *more*
J. F. Eastwood (1890, McDaniell's orch.)	Much *less*	Much *more*	Considerably *more*

From this comparison it will be seen that the analyses made under direction of the department of agriculture (the last four) agree substantially among themselves, but contradict the earlier analyses. In case of the analyses by Professor KEDZIE and Dr. GOESSMAN, no statement is made as to the exact age, location of parts, and relative proportion of the various parts of the branches taken for analysis, and this renders them practically valuless, because the amount of the various chemical constituants in a tree varies greatly according to the kind of tissue, the age, and the location of the part.

The analyses made by Mr. KNORR show that the diseased twigs contain *less* lime and *more* potash and phosphoric acid than healthy twigs, and the series made by Dr. EASTWOOD tend to confirm this view, although in one instance he found slightly less P_2O_5 and in another about the same K_2O.

The diseased branches collected for Mr. KNORR were the shoots of one season. They had made a comparatively meager growth and were in a less mature state than the corresponding healthy shoots.

The shoots sent to Dr. EASTWOOD were of one season's growth, and those in particular from Mr. GREEN's orchard were just as near comparable as it is possible to get diseased and healthy growths. The diseased shoots in each case had made a less robust growth and were slightly less mature than the healthy ones, owing to the well known tendency of diseased branches to continue feeble growths late into the autumn and to develop unusually early in the spring.

These results, reached independently by two competent chemists, upset the old views completely, and are exactly what I was led to expect from the well established physiological law that in the ash of the shoots of land plants, lime increases and potash and phosphoric acid diminish in proportion as the parts become well developed and approach maturity. To

illustrate, in a given weight of growing peach twigs, leaves included, there is more lime in June than in April, more in August than in June, and more in October than in August. The reverse of these statements holds good for potash and phosphoric acid, the young and actively growing shoots being gorged with compounds of potassium and phosphorus, which decrease in quantity as growth progresses, until they reach an amount normal for the mature growths of the plant in question. The growth under the influence of peach yellows appears to be no exception to this rule. The amount of lime increases and the amount of potash and phosphoric acid diminishes in the ash in proportion as the growths approach maturity. They never reach the same robustness or degree of maturity as healthy shoots, and consequently might be expected to contain less lime and more K_2O and P_2O_5 than healthy shoots of a corresponding age. It would appear from the analyses by the Connecticut station, and from Professor EASTWOOD'S determinations, that diseased shoots contain absolutely less ash than normal shoots, which is also what we should expect.

In conclusion, it may be remarked (1) that there are not yet enough analyses of the peach itself to make comparative studies of the fruit of any value, and (2) that all analyses of this kind are quite open to the criticism that they can rarely be actually comparative, and therefore have only a very moderate value.

I now invite your attention to some field experiments.

FIELD WORK.

For three years the department of agriculture has carried on, in the peach yellows region of Maryland and Delaware, a series of experiments using chemical fertilizers. Some of these experiments have followed the lines laid down by Dr. GOESSMAN and Professor PENHALLOW. The entire series includes over forty acres of treated trees, selected from a dozen orchards in two counties, with more than one hundred acres held for comparison. A synopsis of these experiments will be published by the department of agriculture, and it is my purpose here to present only one set, but enough to show that the chemical or starvation theory of peach yellows breaks down when put to actual and practical test in the peach orchards.

For this set of experiments, which I shall designate the Goessman-Penhallow treatment, 340 trees were selected in the middle of one of the finest peach orchards in Delaware. This orchard contains thirty acres. It was planted in 1882, received constant care, grew thriftily, and was practically free from yellows until 1887. The trees selected for treatment and for control were of quite uniform growth and appearance. They stood at a uniform distance (20 x 20 ft.), upon level and very uniform soil, consisting of six to nine inches of sandy loam, resting on a porous yellow clay. Samples of the soil and subsoil of this orchard were exhibited. The original timber of this farm was a heavy growth of oak, tulip tree, walnut, sassafras, holly, and gum. The soil has been in cultivation many years. The wheat product of this farm now averages about thirty bushels per acre with a moderate amount of phosphate, and the corn crop about sixty bushels. Apple trees on the same farm reach a large size and are productive.

The experimental plats were numbered A to D and arranged as shown in the following diagram, 100 trees, separating A B from C D, being used for comparison.

TABLE II.—*Showing cases of peach yellows by years on treated and untreated plats in orchard of James W. Green, Magnolia, Delaware.*

A	60 trees.	Control 100 trees.		C	60 trees.
Year	Cases.	Year.	Cases.	Year.	Cases.
1888.	4	1888	5	1888.	3
1889.	2	1889	0	1889.	5
1890.	2	1890	15	1890.	3
1891.	12	1891	41	1891.	26
B	60 trees.	FRUIT PRODUCT.		D	60 trees.
Year.	Cases.	1882, 1883, 1884, 1885	No fruits.	Year.	Cases.
1887.	1			1887.	3
1888.	3	1886, 1887	Moderate crops.	1888.	7
1889.	10	1888	Big crop.	1889.	3
1890.	12	1889	Moderate Crop.	1890.	19
1891.	7	1890	No fruit.	1891.	23
		1891	Moderate crop.		

When these treatments began, over 90 per cent. of the trees were healthy, thrifty, and fair to look upon. There were quite a good many cases of yellows in the orchard in 1887 and more in 1888, and it was feared that the whole orchard would finally succumb if something were not done. This particular spot in the orchard was selected because the soil appeared to be uniform, and because the trees had made a uniform growth, and were in a great measure free from signs of disease. With the exception of one row of Christiana on the west side, and one row of Oldmixon on the east side, the trees were all of one variety—Crawford's Late. The difference in variety appears to have exerted no influence upon the results. The cases were determined each autumn, and the fertilzers were applied each spring, beginning with the year 1889. In 1889 and 1890 they were harrowed in. In 1891 they were plowed down three to five inches.

The plats were selected in an orchard where there were several hundred cases of yellows, and in a neighborhood where the disease had been on the increase for several years. When the treatments began, absolutely nothing certain could be predicted as to the course of the disease, but the presumption was strong that an excellent location had been selected for testing the virtues of muriate of potash, dissolved bone black, and kieserite.

When the treatment began, as you will see from the diagram, there were four cases on *A*, four on *B*, three on *C*, and ten on *D*, making a total of twenty-one out of 240 on the treated plats. In the plat of 100 trees held for comparison, there were five cases. Exclusive of *D*, which had twice as many cases to start with, the per cent. of cases on the control and on the treated areas, was almost identical, *i. e.* five per cent. and six per cent.

A received the following mixture at the rate of $3\frac{1}{8}$ lbs per tree, or 337 lbs per acre:

Kieserite (50 per cent. $MgSO_4$)	7.5 lbs
Muriate of potash (50 per cent. K_2O)	45.0
Dissolved bone black (16 to 18 per cent. soluble) and average P_2O_5	135.0
Total	187.5

In 1889 this was evenly distributed from near the trunk of the tree outward so as to cover about two thirds of the surface of the plat. The second spring three fourths of the surface was covered from the trunk outward. The third spring two thirds of the surface was covered in the same manner.

B received the same mixture as *A*, but double the quantity each year, *i. e.*, $6\frac{1}{4}$ lbs per tree or about 675 lbs per acre. The first spring this was broadcasted over the whole surface. The next spring it was sowed from the trunk outward over about four fifths of the surface. The third spring it was sowed in the same manner, but over only about two thirds of the surface.

C received the following mixture:

Kieserite	7.5 lbs
Muriate of potash	90.0
Dissolved bone black	135.0
Total	232.5

In other words, the mixture was the same as for *A*, except that the muriate was doubled.

This was put on annually at the rate of 3.87 lbs per tree, or 418 lbs per acre. The first two springs about four fifths of the surface was covered in the manner already described. The third spring the treated area around each tree was restricted a little, so that only about three quarters of the whole surface of the plat was covered.

D having more cases to start with, was believed to be in greater danger, and was treated more liberally. It received annually $7\frac{3}{4}$ lbs per tree, or 837 lbs per acre of the following mixture:

Kieserite	15 lbs
Muriate of potash	180
Dissolved bone black	270
Total	465

In other words, *D* received the same mixture as *B* and double as much muriate of potash; or, to state the matter still differently, *A* received a minimum of muriate, *B* and *C* received *twice* as much; and *D* received *four* times as much.

About three quarters of the whole surface of *D* was covered the first and third spring, and about nine tenths the second spring, in the manner already described.

The total quantity of fertilizer used on these four plats, during the three years, is as follows:

TABLE III.—*Showing kind and amount of fertilizer used.*

Substance.	Weight in lbs. per plat.			
	A.	*B.*	*C.*	*D.*
Kieserite	22.5	45.0	22.5	45.0
Muriate of potash	135.0	270.0	270.0	540.0
Dissolved bone black	405.0	810.0	405.0	810.0
Total	662.5	1125.0	697.5	1395.0
Rate per acre of 108 trees	1011.	2025.	1254.	2511.0

At time treatments began the branches lacked several feet of touching those of neighboring trees; at present they touch or nearly touch.

Now for results. In addition to Table II, which states the cases by years, it will be sufficient to give the per cent. of cases which have appeared on the control, and on the treated plats since the first appearance of the disease:

TABLE IV.—*Showing per cent. of cases of peach yellows before and after three years' treatment (preventive) with the Goessman–Penhallow mixture.*

Time.	Per cent. of cases.					
	Treated plats.					Control area.
	A	*B*	*C*	*D*	Av'r	
Prior to treatment	6.6	6.6	5.0	16.6	8.8	5.0
Since treatment	26.6	48.3	56.6	75.0	51.6	56.0
Total	33.3	55.0	61.7	91.6	60.4	61.0

Had the trees on the treated plats remained healthy while those on the untreated one contracted the disease, the evidence in favor of the mixture would have been reasonably conclusive, because the experiments were conducted in a region eminently suitable for a test case.

It is apparent that, so far from responding to treatment, plats *A* and B show a large increase of cases, while plats *C* and *D* actually show a larger per cent. of cases at the end of three years than does the untreated one. Another point: With exception of *B*, the cases are more numerous the third year than any preceding year. It will also be observed that the three plats now most affected are the very ones which have received most fertilizers, and especially most of the so-called specific, muriate of potash. Whether this is merely accidental, or is really due to excessive fertilization, is a question I do not wish to raise at this time.

The only point I desire to make is that a practical test on a large scale, covering a period of three years, and in one of the best possible localities for such a test, has shown that this mixture is practically worthless as a remedy for peach yellows, and has also shown that it has no efficacy even as a preventive.

Had these substances been used only one year, it might have been

objected that, being slow to diffuse in the soil, time enough was not allowed for their action; but no such argument can be brought forward to explain the results of a period of years. Neither can it be advanced that the substances have washed away. There has been no surface washing, and it is well known that the soil holds on to potash and phosphoric acid with great tenacity. The disease has increased for three years, *pari passu* with the increase of fertility in the soil.

Not to weary you further with results so purely negative, and in one sense so unsatisfactory, I must conclude this paper, as I did my former one, with expression of the belief that the Goessman-Penhallow method of treatment was founded on an error, and that we are to look for the cause of peach yellows and the means of prevention in an entirely different direction. Concerning the now well-established contagious nature of this disease, see *Bulletin No. 1**, recently published by the division of vegetable pathology of the U. S. department of agriculture.

DISCUSSION.

Dr. Johnson: I should like to ask the Professor one question or two. Has the Professor ever examined the roots of the diseased trees? Is not a healthy root of a peach tree the color of yellowish white, and of a tree that is diseased of redish yellow?

Dr. Smith: I have never found any constancy in that matter.

Mr. Cary: The question I wish to ask is this: I do not think in Georgia we have yellows. We have a disease, but it is not yellows. I want to ask this question: Does yellows kill the tree which it attacks the first year?

Dr. Smith: It is not likely to. I have sometimes known a tree to be killed in one year, more in two, but a majority not under four, five, or six years.

Mr. Cary: Will they bear perfectly for the second or third year?

Dr. Smith: Sometimes part of the tree will bear perfect fruit the second or even the third year. It depends on how seriously it is attacked at the start.

Mr. Cary: We have in Georgia a disease called "rosette"—it assumes that form, but Mr. Berckmans and Colonel Redding both say it is not yellows. It is fatal and kills out the trees, but I don't know what it is.

Dr. Smith: It is dangerous, seriously so; quite as much as peach yellows. but I think different from it. I have studied it carefully for two years.

Mr. Garfield: I should like to inquire whether the gentleman has found peach yellows in New Jersey and Massachusetts.

Dr. Smith: I have been in New Jersey and Massachusetts, and have seen yellows in both places, and I believe yellows occurs from one end to the other of both states. I do not think there is a peach-growing county in either state wholly exempt; and I have seen a great many cases which I consider to be identical with the Michigan yellows.

Mr. Engle: Will the peach take yellows when worked on the plum?

Dr. Smith: I began several series of that kind of experiment this year, budding on plums and cherries, to determine whether the disease can be transmitted to these plants It is perhaps too soon to expect results. One

* Dr. Smith's "Additional Evidence." See page 165, this volume.

thing more with reference to the fertilizers: I did not mean to be understood as condemning in the least the use of these substances for other purposes. The effect on the fruit has been marked. It has been finer, larger, and altogether better. I was talking about the prevention and cure of yellows, and not of the use of these fertilizers for other purposes. There has been more growth and better fruit on the treated blocks. I ought to say a word more with reference to the plum. I think I misunderstood Mr. Engle's question.

Mr. ENGLE: My question was, whether it would prevent yellows by budding on plums?

Dr. SMITH: I understood the question to be whether yellows could be induced in plums. Three years ago a thousand well-rooted Mariana plum cuttings were picked out and peach buds worked upon them. These were divided into three lots and set into three very badly diseased orchards further up the Chesapeake and Delaware peninsula. It will be some years before I can speak definitely as to results.

SPRAYING FOR INSECT PESTS AND FUNGOUS DISEASES.

SPRAYING FOR INSECT PESTS.

The distribution of insecticide mixtures in the form of spray was first begun in this country on a large scale during the early spread of the Colorado potato beetle in the western states. Paris green was first used in 1869 both as a dry mixture diluted with flour, ashes, plaster, or slaked lime, and in liquid suspension in water. Spray machines soon came into use, and this method of application of insect-destroying mixtures was speedily extended to other insect pests. In 1878 poisoned spray was first used against the codlin moth, and the entomologist of the department had previously recommended this remedy for the cotton worm and several other leaf-eating insects. During the progress of the investigation of the cotton worm many spraying machines were developed, and from that time to the present the development of methods and machinery has been rapid, until at the present time the best remedies against perhaps the majority of our principal insect pests comprehend the application of an insecticide spray at one time or another.

INSECTICIDES USED IN THE FORM OF A SPRAY.

Kerosene emulsion.—This insecticide acts by contact and is applicable to all non-masticating insects (sucking insects, such as the true bugs and especially plant lice and scale insects) and also to many of the mandibulate or masticating insects, such as the apple worm or plum curculio, when the use of arsenites is not advisable. Kerosene emulsion may be made by means of various emulsifying agents, but the most satisfactory substances, and those most available to the average farmer and fruitgrower, are milk and soapsuds. In each of these cases the amount of emulsifying agent should be one half the quantity of kerosene.

One of the most satisfactory formulas is as follows:

			Per cent.
Kerosene	gallons	2	67
Common soap or whale-oil soap	pounds	½	33
Water	gallons	1	

Heat the solution of soap and add it boiling hot to the kerosene. Churn the mixture by means of a force pump and spray nozzle for five or ten minutes. The emulsion, if perfect, forms a cream which thickens upon cooling and should adhere without oiliness to the surface of glass. If the water from the soil is hard or has a large percentage of lime, add a little lye or bicarbonate of soda, or else use rain water. For use against scale insects dilute one part of the emulsion with nine parts of cold water. For most other insects dilute one part of the emulsion with fifteen parts of water. For soft insects like plant lice the dilution may be carried to from 20 to 25 parts of water.

The milk emulsion is produced by the same methods as the above.

THE ARSENITES: LONDON PURPLE, PARIS GREEN, AND WHITE ARSENIC.

These poisons are of the greatest service against all masticating insects, as larvæ and beetles, and they furnish the most satisfactory means of controlling most leaf-feeders, and the best wholesale remedy against the codlin moth. Caution must be used in applying them, on account of the liability of burning or scalding the foliage.

The poisons should be thoroughly mixed with water at the rate of from 1 pound to 100 to 250 gallons of water, and applied with a force pump and spray nozzle. In preparing the wash, it will be best to first mix the poison with a small quantity of water, making a thick batter, and then dilute the latter and add to the reservoir or spray tank, mixing the whole thoroughly. When freshly mixed, either London purple or Paris green may be applied to apple, plum, and other fruit trees except the peach, at the rate of 1 pound to 150 to 200 gallons, the latter amount being recommended for the plum, which is somewhat more susceptible to scalding than the apple. White arsenic does little if any injury at the rate of 1 pound to 50 gallons of water when freshly mixed. As shown by Mr. GILLETTE, however, when allowed to remain some time (two weeks or more) in water, the white arsenic acts with wonderful energy, scalding, when used at the rate of 1 pound to 100 gallons, from 10 to 90 per cent. of the foliage; the action of the other arsenites remains practically the same, with perhaps a slight increase in the case of London purple.

With the peach these poisons, when applied alone, even at the rate of 1 pound to 300 or more gallons of water, are injurious in their action, causing the loss of much of the foliage.

By the addition of a little lime to the mixture, London purple and Paris green may be safely applied, at the rate of 1 pound to 125 to 150 gallons of water, to the tenderest peach foliage, or in much greater strength to strong foliage, such as that of the apple or most shade trees.

Whenever, therefore, the application is made to tender foliage, or when the treating with a strong mixture is desirable, lime water, milky, but not heavy enough to close the nozzle, should be added at the rate of about 2 gallons to 100 gallons of the poison.

With the apple, in spraying for the codlin moth, at least two applications should be made, the first after the falling of the blossoms or when the apples are about the size of peas, and the second a week or ten days

later. The first brood of the codlin moth lays its eggs in the flower end of the young apple, and the worms upon hatching gnaw their way into the interior of the apple, and on sprayed trees are poisoned in so doing, an infinitesimal amount being sufficient to destroy so minute a worm. The second spraying is for the purpose of destroying larvæ hatching from eggs which may be laid after the first spraying, as the arsenic is gradually washed off by rains.

For the plum curculio on the plum, cherry, peach, etc., two or three applications should be made during the latter part of May and the first half of June. The poison in this case is applied for the purpose of destroying the adult curculios which hibernate and gnaw into the young growth of the trees and even into the hard young fruit before laying their eggs. The eggs are pushed under the skin so that the larvæ are not ordinarily affected by the poisoning.

In the case of most leaf-feeding insects one should spray on the first indication of their presence.

Caution necessary in the use of these insecticides.—The relative susceptibility of apple, plum, and peach has just been indicated under the head of arsenical poisons, and these remarks apply equally well to the use of kerosene emulsions. In the case of other plants, thorough experiments are still necessary, and all insecticides should be used in comparatively high dilution. Tender-leaved plants, such as melons and cucumbers, are more readily injured; while plants with firmer and smooth leaves, like the orange, are least affected. Annual plants. such as cabbages and other garden vegetables, are more susceptible than perennials; but in the case of root crops, such as beets, turnips, radishes, and potatoes, there is not the same need of caution as to damage to foliage. Damage to foliage is not shown at once, and in case of rain following an application another application should not be made for several days. Fruit trees should not be sprayed with arsenical poisons while in blossom, as there is no advantage in doing so, and honey bees are reported to be at times killed by working in the sprayed blossoms.

SPRAYING FROM THE HYGIENIC STANDPOINT.

The only insecticide sprays which are at all dangerous to use are the arsenic compounds, and even here the danger is greatly exaggerated by those not conversant with the facts. Paris green and London purple have for many years been extensively used in this country as insecticides and a case of fatal poisoning from their use as such has never been substantiated. The only danger lies in having the poison about a farm or plantation in bulk. In the early days of the use of Paris green against the Colorado potato beetle a great deal of opposition was developed on account of the supposed danger, and only recently the sale of American apples in England has received a set-back owing to the supposed danger of arsenic poisoning from their consumption. The question as to whether arsenic may be absorbed by the growing plant in any degree was long ago settled in the negative by the best chemists in the country. Dr. WILLIAM McMURTRIE, formerly chemist of this Department, in 1878, showed that even where Paris green was applied to the soil in such quantities as to cause the wilting or death of the plants, the most rigorous chemical analysis could detect no arsenic in the composition of the plants themselves. Other experiments in a similar direction, by Prof. R. C. KEDZIE of the Michigan

Agricultural college, confirmed these conclusions. It is safe, then, to assume that the only way in which fruit or vegetables can convey the poison to the consumer will be through the very minute quantity of arsenic left upon the edible part of the plant. Against the possibility of such an effect the following facts may be urged:

(1) It would seem at first glance that the use of an arsenical poison upon a plant like the cabbage would be very unsafe to recommend, yet Paris green and London purple are used upon this crop to kill the several species of leaf-eating worms which are so destructive to it, and an absolute absence of all danger where the application has been properly made has been recently shown by Prof. GILLETTE of the Agricultural experiment station of Colorado, by the following *reductio ad absurdum:*

* * * Where the green is dusted from a bag in the proportion of 1 ounce of the poison to 100 ounces of flour and just enough applied to each head to make a slight show of dust on the leaves, say for twenty-eight heads of cabbage, 1 ounce of mixture, the worms will all be killed in the course of two or three days, while the average amount of poison on each head will be about one seventh of a grain. Fully one half of the powder will fall on the outside leaves and on the ground, and thus an individual will have to eat about twenty-eight heads of cabbage in order to consume a poisonous dose of arsenic, even if the balance of the poison remained after cooking.

(2) In case of spraying apple orchards for the codlin moth there is scarcely a possibility of injury to the consumer of the fruit. A mathematical computation will quickly show that where the poison is used in the proportion of 1 pound to 200 gallons of water (the customary proportion) the arsenic will be so distributed through the water that it will be impossible for a sufficient quantity to collect upon any given apple to have the slightest injurious effect upon the consumer. In fact, such a computation will indicate beyond all peradventure that it will be necessary for an individual to consume several barrels of apples at a single meal in order to absorb a fatal dose even should this enormous meal be eaten soon after the spraying and should the consumer eat the entire fruit.

(3) As a matter of fact, careful microscopic examinations have been made of the fruit and foliage of sprayed trees at various intervals after spraying, which indicate that after the water has evaporated the poison soon entirely disappears either through being blown off by the wind or washed off by rains, so that after fifteen days hardly the minutest trace can be discovered.

(4) In the line of actual experiment, as indicating the very finely divided state of the poison and the extremely small quantity which is used to each tree, Prof. A. J. COOK of the Michigan Agricultural college, has conducted some striking experiments. A thick paper was placed under an apple tree which was thoroughly sprayed on a windy day so that the dripping was rather excessive. After the dripping had ceased, the paper (covering a space of 72 square feet) was analyzed, and four tenths of a grain of arsenic was found. Another tree was thoroughly sprayed and subsequently the grass and clover beneath it was carefully cut and fed to a horse without the slightest sign of injury.

The whole matter was well summed up by Professor RILEY in a recent lecture before the Lowell Institute, in Boston, in the following words:

The latest sensational report of this kind was the rumor, emanating from London, within the last week, that American apples were being rejected for fear that their use was unsafe. If we consider for a moment how minute is the quantity of arsenic that can, under the most favorable circumstances, remain in the calyx of an apple, we shall

see at once how absurd this fear is; for, even if the poison that originally killed the worm remained intact, one would have to eat many barrels of apples at a meal to get a sufficient quantity to poison a human being. Moreover, much of the poison is washed off by rain, and some of it is thrown off by natural growth of the apple, so that there is, as as a rule, nothing left of the poison in the garnered fruit. Add to this the further fact that few people eat apples raw without casting away the calyx and stem ends, the only parts where any poison could, under the most favorable circumstances remain, and that these parts are always cut away in cooking, and we see how utterly groundless are any fears of injury and how useless any prohibitive measures against American apples on this score.

SPRAYING FOR FUNGOUS DISEASES OF THE APPLE, PEAR, AND OTHER FRUITS.

Probably in no other country of the world is spraying for fungous diseases of fruits practiced to the same extent as in the United States. Five years ago practically nothing was known of this subject; in fact, the number actively engaged in spraying their trees, vines, etc., for such diseases as apple-scab, black-rot, downy mildew, and other diseases of the grape, did not exceed half a hundred, all told. Now, as a fair estimate, probably no less than 50,000 fruitgrowers are engaged in this work. From the Atlantic to the Pacific, and from the great lakes to the gulf, the methods recommended by the department are practiced every year. Canada has also adopted many of the suggestions made by us, and even now Australia is actively engaged in experiments in the treatment of apple, pear, peach, and other diseases, in accordance with suggestions originating with this department.

DOES IT PAY TO SPRAY?

This question is in large part answered by the facts already given. No work that did not carry merit with it could have had such a phenomenal growth. To give a more direct answer, however, it may be stated that last season two hundred and fifty grape-growers in different parts of the country made a series of observations with a view to obtaining some definite information as to the value in dollars and cents of the recommendations made by the department in the treatment of grape diseases. The facts reported by these men show conclusively that the actual profit to them over all expenses, resulting from the treatment of black-rot and downy mildew, was in round numbers $37,000. Thirteen thousand dollars of this sum was reported from the state of New York alone.

Other examples equally as striking could be given, but this is sufficient for our purpose. Of course every one is not successful, but where failure is reported it is usually easy to locate and remedy the trouble.

FUNGICIDES OR REMEDIES USED IN SPRAYING.

Numerous preparations have been recommended and used for this work. For all practical purposes, however, there are but four which properly may be called remedies. They are (1) Bordeaux mixture, (2) ammoniacal solution of copper carbonate, (3) eau céleste, and (4) modified eau céleste. The latest experiments indicate that the best results will follow the use of these preparations when made as follows:

1.—Bordeaux Mixture.

In a barrel that will hold 45 gallons, dissolve 6 pounds of copper sulphate, using 8 or 10 gallons of water or as much as may be necessary for the purpose. In a tub or half barrel slake 4 pounds of *fresh* lime. When completely slaked add enough water to make a creamy whitewash. Pour this slowly into the barrel containing the copper-sulphate solution, using a coarse gunny sack stretched over the head of the barrel for a strainer. Finally fill the barrel with water, stir thoroughly, and the mixture is ready for use. Prepared in this way the cost of 1 gallon of the mixture will not exceed 1 cent, the price of copper sulphate being 7 cents per pound and lime 30 cents per bushel. In all cases it is desirable to use powdered copper sulphate, as it costs but little more and dissolves much more readily. It is highly important also that fresh lime be used.

It will be seen by those familiar with former suggestions made by the department that the strength of this mixture has been diminished one half. It was found as the result of experiments made in 1891 that a mixture of this strength, and even much weaker, gave practically as good results as the old formula, which required 6 pounds of copper sulphate and 4 pounds of lime to 22 gallons of water.

2.—Ammoniacal Solution of Copper Carbonate.

In an ordinary water pail mix 5 ounces of copper carbonate with enough water to make a thick paste. Dissolve this paste in three pints of strong aqua ammonia; then dilute to 45 gallons. If three pints of ammonia are not sufficient to dissolve all the paste add enough to bring about this result. Copper carbonate occurs in the market in the form of a fine greenish powder. The retail price is usually 60 cents per pound. Aqua ammonia having a strength of 26° retails at 8 cents per pound. Upon this basis 1 gallon of the ammoniacal solution of copper carbonate will cost one cent.

In view of the fact that copper carbonate is sometimes difficult to obtain the following directions for manufacturing it are given:

In a half-barrel, or some similar vessel, dissolve 3 pounds of copper sulphate in 2 gallons of hot water. In another vessel dissolve 3½ pounds of common washing soda or sal soda in 1 gallon of hot water. When cool pour the second solution slowly into the first; then as soon as all action has ceased add enough water to bring the whole up to 8 or 10 gallons and stir thoroughly. In twenty-four hours pour off the clear liquid, taking care not to disturb the sediment. Add fresh water and stir again. Again allow the solution to stand twenty-four hours, pour off the clear liquid as before; then remove the sediment which is copper carbonate. Prepared in this way there is formed 1½ pounds of copper carbonate at an expense for materials of approximately 18 cents per pound. The copper carbonate paste may be immediately dissolved in aqua ammonia, using 2 gallons of the latter, or as much as may be necessary for the purpose. This concentrated fluid should be kept in well corked jugs and when ready for use should be diluted at the rate of 1 pint to 12 gallons of water.

3.—Eau Céleste.

Dissolve 2 pounds of copper sulphate in 8 gallons of water. When completely dissolved add 3 pints of strong ammonia and dilute to 45 gal-

lons. Prepared in this way the solution will cost about two thirds of a cent per gallon.

4.—Modified Eau Céleste.

Dissolve 4 pounds of copper sulphate in 10 or 12 gallons of water and stir in 5 pounds of washing or sal soda; then add 3 pints of strong aqua ammonia, dilute to 45 gallons. The cost will be 1½ cents per gallon.

HOW AND WHEN TO SPRAY.

It should always be borne in mind that no hard and fast rules can be laid down for work of this kind. Frequently the fruitgrower will have to use his own judgment, especially as regards the number of sprayings and the proper time to discontinue them. If this be not done serious results may follow. In the treatment of black-rot of the grape we have known vine-growers to continue the application of Bordeaux mixture through a protracted drought up to the time of ripening of the fruit. As a result when the time arrived to send the grapes to market they were so badly spotted with the mixture that no one would buy them. Again we have found fruit-growers thoroughly imbued with the idea that the only proper way to spray was to rush through an orchard or vineyard with some new-fangled complicated machine, applying the solutions in daubs at one point and omitting whole trees or blocks of vines at another. Such work is to be regretted, as it may be the cause of much loss to those who have acted carefully and intelligently in the matter. For example, in the case of the grape scare in New York city the past summer, grape-growers all over the country were made to suffer, partly through the folly of a few over-zealous individuals who upon their own responsibility made more applications than were necessary and partly through the action of a somewhat hasty board of health.

Before taking up the subject of treatments proper it may be well to emphasize the importance and necessity of using the right kind of machinery. A sprayer to be effective requires first of all a good strong force pump. Next in importance is a nozzle that will throw a mist-like spray and will not clog when thick fluids are used. There are plenty of machines on the market filling all these requirements. For convenience they may be divided into three classes: (1) horsepower automatic machines, (2) machines drawn by horse power but operated by hand, and (3) hand machines. All belonging to the first group may be dismissed with the statement that they are unnecessarily expensive and complicated, and will not, even in the most careful hands do the work as thoroughly and effectively as the machines belonging to the second and third groups. Of the second group, in which the cheapest, most practical and efficient example is found in a strong light, double-acting, double-discharge force pump mounted on a barrel, it may be said that while they can not do the work as rapidly as the machines of the first class, they are more effective, much cheaper, and far less wasteful of the liquid used. To the third class belong the knapsack sprayers, which are the only ones necessary to notice in this connection. There is no question that for all moderately low-growing crops the knapsack sprayer fills every requirement. In no other machine is the work so absolutely at all times under control, it being possible to place nearly every drop of the liquid exactly where it is wanted.

Knapsack pumps are now used in many moderate-size vineyards, also in places where the horsepower apparatus, owing to the nature of the land or the manner of cultivation, cannot be utilized.

Many firms throughout the country, as will be seen by reference to the columns of any good agricultural paper, are engaged in the manufacture and sale of the various machines mentioned.

Taking up the question of spraying more specifically we would call attention first to apple diseases and their treatment.

TREATMENT OF APPLE SCAB.

For this disease either modified eau céleste or ammoniacal solution of copper carbonate, preferably the former, may be used. At least four sprayings should be made, the first just as the flowers are opening, the second twelve or fourteen days later, and the third and fourth at similar intervals. In case the season is wet one or two additional treatments will undoubtedly pay. For trees 15 to 18 feet high the cost of four sprayings with either of the fungicides mentioned need not exceed 20 cents per tree. When the work is done on a large scale 16 to 18 cents per tree will cover the cost of four treatments. Two additional treatments will add to the cost from 6 to 8 cents per tree.

APPLE POWDERY MILDEW.

It is only in nurseries that this disease is destructive. Seedlings are especially subject to the mildew, the leaves being attacked as soon as they appear. As a result the trees make very little growth, are bark bound, and consequently unfit for budding. The ammoniacal solution has proved the cheapest and most effective remedy for this disease, and five sprayings seem to be required. The first application should be made just as the leaves start in spring. At least three other sprayings should be made at equal intervals between the time of the first treatment and the time for budding. Ten or twelve days after budding the last spraying should be made, making five in all. For blocks of 50,000 to 100,000 seedlings the total cost of the treatment, as indicated, need not exceed 8 cents per thousand. In smaller blocks the average cost per thousand trees will be somewhat greater, as it requires practically as much time to prepare to spray 25,000 trees as it does 50,000. The knapsack pump is well adapted to this work and is extensively used by nurserymen.

TREATMENT OF PEAR SCAB, CRACKING AND LEAF-BLIGHT.

These diseases, caused by two different species of fungi, are now successfully combatted by one line of treatment. In most sections all three diseases are found associated. Bordeaux mixture has given the best results in this work, although ammoniacal solution has proved almost as effective. The only objection to the latter is that it sometimes gives the fruit a rusty appearance, which is not at all desirable. The first spraying for these diseases should be made when the trees are in flower. In ten or twelve days a second treatment should be made, followed by a third and fourth at the expiration of two and four weeks respectively. In the nursery, pear leaf-blight is often exceedingly troublesome. It may be almost entirely prevented by spraying five or six times with the Bordeaux mixture, making

the first application when the leaves are about one-third grown and the others at intervals of ten or twelve days throughout the season.

The cost of treating full-grown standard trees with the Bordeaux mixture as indicated will average from 12 to 14 cents per tree. For dwarf trees the cost will range from 8 to 12 cents each. The cost of treating with the ammoniacal solution will be considerably less, probably not exceeding ten cents for standard and 8 cents for dwarf trees. In the nursery pear seedlings can be treated six times with the Bordeaux mixture for 50 cents per thousand.

TREATMENT OF LEAF-BLIGHT OF THE CHERRY, PLUM, AND QUINCE.

This disease. which seriously damages the trees both in the nursery and orchard, may be readily held in check by the proper use of either Bordeaux mixture or the ammoniacal solution. In the orchard and nursery the directions laid down for the treatment of pear scab, cracking, and leaf-blight are applicable here.

TREATMENT OF BLACK-ROT OF THE GRAPE.

Method A.—After pruning the vineyard and putting the ground in thorough order spray the vines first, as the buds begin to swell, with Bordeaux mixture. When the leaves are one-third grown make a second application of the same fungicide, following with a third when the vines are in full bloom. After this applications should be continued at intervals of ten or twelve days until the first signs of ripening are noticed. This will usually be three weeks or a month before the grapes are ready to pick. In no cases hould the treatments be continued up to the time of harvest, as this is entirely unnecessary; moreover it is sure to render the fruit unsightly. It is important to bear in mind that in case of dry weather the sprayings should cease.

Method B.—Following the direction laid down under method *A*, with the exception that the ammoniacal solution be used instead of Bordeaux mixture.

Method C.—For the first three sprayings use the Bordeaux mixture, then substitute the ammoniacal solution for the rest of the season.

The cost of the treatment as laid down in method *A* need not exceed 2½ cents per vine. Method *B* will cost 2 cents and method *C* the same.

So far as efficacy is concerned there is little choice. All things considered, however, method *A* will doubtless prove the most satisfactory.

DOWNY MILDEW OF THE GRAPE.

When this disease occurs alone ammoniacal solution or modified eau céleste may be used. The first spraying should be made when the fruit is well formed, the others at intervals of ten or twelve days as recommended for black-rot. What is known as brown-rot is caused by the fungus of downy mildew. It is seldom that brown-rot occurs in the berries without the leaves being also affected. In regions where this happens the treatment recommended for black-rot should be followed.

In some sections eau céleste has been more effective against these diseases than any of the other fungicides. This is notably the case in northern

Ohio and western New York. Eau céleste, however, sometimes injures the foliage, and we do not advise its extended use.

ANTHRACNOSE OF THE GRAPE.

Use Bordeaux mixture the same as recommended for black-rot under method *A*.

USE OF COPPER COMPOUNDS FROM HYGIENIC STANDPOINT.

Ever since the copper compounds came into general use as fungicides the question as to their effects, hygienically considered, has received more or less attention. With the exception of the New York city board of health no positive stand on this question has been taken, so far as we are aware. Many vague and misleading statements, however, have from time to time appeared in the horticultural and agricultural papers. Every one familiar with the situation understands why these rumors, for such they can only be considered, are sent out. They are not aimed particularly at the practice of spraying, but are simply efforts on the part of selfish competitors to cripple the legitimate trade of more energetic and wide-awake rivals.

We take the ground that fruit sprayed with the copper compounds in accordance with the directions of the department is harmless. No better proof of this is to be found than that shown by the experience of this country. For five years the copper compounds have been used by hundreds and thousands of fruitgrowers in every part of the United States, yet in all that time not a single authenticated case of poisoning, so far as we are aware, has been brought to light. It is true a few individuals have claimed that they were made sick by eating sprayed fruit, but in all such cases careful investigations have revealed that claims of this kind were absolutely without foundation. However, we do not consider these general statements sufficient to warrant us in taking the stand as regards the harmlessness of the copper compounds when properly used. More direct testimony is readily obtained and some of this we now propose to consider. The question may properly be discussed under two heads, namely:

(1) The present condition of our knowledge as regards the toxicology of copper; and

(2) Are the salts found in sufficient quantity upon the fruit at the time of harvest to prove injurious to health?

No doubt the majority of people, including physicians, would answer the first statement at once by saying that copper is a poison. When we come to look carefully into the matter, however, it is found that the very best authorities differ on the subject. For more than a hundred years the question as to the poisonous nature of copper has been discussed, and yet, after reading all the testimony, it is exceedingly difficult from the evidence adduced to form a definite opinion.

In 1885 the question was discussed before the Belgium royal academy of medicine for seven months, the object being to obtain some authoritative data as to the effect of copper, contained in French canned vegetables, on the public health. While it was finally decided that the copper compounds in foods were harmful, no direct stand as to the poisonous nature of the substances was taken. Those who antagonized the view that copper was an actual poison cited many eminent authorities to bear out their assertions. In the whole discussion, however, it was remarkable that not a

single case of injury to health resulting from the daily absorption of small quantities of copper was given. Many instances were cited, however, where foods containing copper in considerable amounts were daily consumed without any ill effects whatever. It is interesting to note in this connection that notwithstanding the discussion before the Belgium academy the law of July, 1882, prohibiting the use of copper in the re-greening of fruits was repealed by the French authorities in the department of the Seine. It appears, therefore, from all the evidence on the subject, that the question under consideration is not settled by any means. For this reason alleged cases of poisoning with copper should receive the most careful investigation.

We presume no one will deny that copper in large or even moderate doses is unwholesome. Looking at the question from this standpoint, let us consider the second part of our subject, *i. e.*, Are the salts found in sufficient quantity in connection with properly sprayed fruit, at the time of harvest, to cause injury to health? At this point it may be well to add that all our remarks apply to the Bordeaux mixture, which contains about twenty times as much copper as the ammoniacal solution, the only additional fungicide worthy of consideration on account of its extended use.

According to GAUTHIER, professor of chemistry of the faculty of medicine, Paris, an adult can absorb daily for a period of several weeks without ill effects from 0.2 to 0.5* grams of copper sulphate, or blue vitriol. Five-tenths of a gram is usually considered the maximum amount that may be absorbed for any length of time without injury to health, although cases are on record where as high as 2, 3, and even 4 grams have been absorbed for a number of days in succession without any ill effects whatever. Some recent French investigations have shown that a dog can absorb from 15 to 25 grams of copper sulphate without injury. Sheep have been fed 43 grams per day for several days in succession without any noticeable derangement of the system.

At this point we are confronted with a somewhat complex chemical question which makes it difficult to obtain results strictly comparable. The Bordeaux mixture as elsewhere shown, is made by the addition of lime to a solution of copper sulphate. According to recent investigations, the reaction is an exceedingly complicated one, the details of which are unnecessary here. It has generally been accepted that the mixture as sprayed upon the vines consists for the most part of copper hydrate, which upon drying becomes an insoluble compound. We have, therefore, first of all. the question to consider whether the hydrate is as likely to prove injurious to health as the sulphate in solution. No direct investigations upon this point have, so far as we know, been made. It has been shown, however, that doses of copper four or five times greater can be administered in an insoluble than in a soluble state. The question now briefly stated resolves itself into this: May we, without assuming too much, use the facts bearing on the harmfulness or harmlessness of copper sulphate when considering copper hydrate and copper oxide? We believe that this assumption is not only admissible but is erring upon the safe side; in other words, that if an adult can safely absorb 0.5 grams of copper sulphate a day without injury, he may with much less fear of ill effects absorb the same quantity of copper hydrate and copper oxide. In fact, as regards the ill effects of the

*1 gram equals 15.438 grains.

latter. hygienically considered, there is a great deal of evidence which will be considered later.

Accepting, then, 0.5 grams as the maximum amount of copper in any of the forms discussed that may with safety be daily absorbed, let us see how these figures compare with the quantity of this metal found in connection with properly sprayed fruits as well as some other foods and drinks. Analyses to determine the amount of copper on sprayed grapes have been made in Germany, France, America and other countries. The result of all of these show that grapes sprayed intelligently rarely contain more than 5 milligrams (0.005 gram) of copper per kilogram, the average being from 2½ to 3 milligrams per kilogram. In other words, 1,000,000 pounds of grapes sprayed in the usual way with the Bordeaux mixture would contain from 2½ to 5 pounds of copper. To reduce the figures still further, each 100 pounds of fruit would contain 17.5 to 35.0 grains of copper. On this basis an adult may eat from 300 to 500 pounds of sprayed grapes per day without fear of ill effects from the copper. This shows how ridiculously absurd are the statements that fruits properly sprayed with the Bordeaux mixture or any other copper compound are poisonous.

Turning our attention to another phase of the subject, let us consider some other articles of food and drink in no way connected with spraying. In the first, place it has recently been shown that grapes which have never been treated with any fungicide may contain as much as 2 milligrams of copper per kilogram—two parts in a million, or practically the same as the average amount found in connection with sprayed fruit. Finding copper, therefore, in connection with fruit is no indication that such fruit has been sprayed with the copper compounds. Perhaps if this fact is remembered in the future it may prevent hasty conclusions and consequent annoyance.

According to numerous analyses wheat may contain from 4 to 10 milligrams of copper per kilogram, the average being 7.2 milligrams per kilogram. The United States exported to Europe and other foreign countries in 1890, 54,387,767 bushels of wheat weighing approximately 3,263,020 pounds, or 1,480,217,466 kilograms. If each kilogram of wheat contained 7.2 milligrams of copper, then there were 10,667 kilograms or 23,490 pounds of this metal sent out of the country in wheat alone. In the face of these figures we do not see how any foreign country can logically object to American fruits on the ground that they contain copper without also objecting to wheat.

Wheat, however, does not contain anything like as much copper as some other foods and drinks. Beef and sheep liver, according to reliable and repeated analyses, contain respectively 56 to 58 and 35 to 41 milligrams of metallic copper per kilogram of fresh substance, while in chocolate the enormous amount of 125 milligrams to the kilogram has been found. In conclusion, it is only necessary to call attention to one other matter to show how unjust and discriminating it would be to condemn American fruits on the ground that they contain copper in unwholesome quantities. Brief reference has already been made to the re-greening of vegetables, as practiced by the French. Peas, beans, cucumbers, and similar products are plunged for eight or ten minutes into a solution of copper sulphate in order to fix the natural green coloring matter. After removing the vegetables from the copper sulphate solution they are washed in pure water, placed in jars containing a solution of common salt, sealed and sterilized by heat.

The analyses of such vegetables show that they contain copper in considerable quantity, as will be seen by consulting the table below:

Table showing copper in 1 kilogram of re-greened canned vegetables.

Vegetables.	Authority.	Amount of copper.
		Milligrams.
Peas	Gallippe	48 to 60
do	Carles	70 to 210
do	Gautier	11 to 125
Beans		49 to 99
Cucumbers	Magnier	2
Tomatoes	Sestini	50 to 354

It appears from the foregoing that vegetables re-greened by the copper process may contain from two to sixty times as much of the metal as sprayed grapes. In other words, if 1,000,000 pounds of sprayed grapes contain 5 pounds of copper, 1,000,000 pounds of re-greened vegetables would contain from 38 to 150 pounds of the metal. Great Britain imported over 14,000,000 pounds of canned vegetables from France in 1890, and it is safe to say that these vegetables contained more than twenty times as much copper as all the sprayed fruit in the United States combined.

FUNGOUS DISEASES OF THE GRAPE AND THEIR TREATMENT.

GRAPE DISEASES.

There are but four fungous diseases of the grape in this country which occasion sufficient damage to warrant our attention in this bulletin. They are: (1) The grape peronospora or downy mildew; (2) powdery mildew; (3) black rot, and (4) anthracnose. These we shall endeavor to describe in such a way that any one not familiar with them may be able to recognize them and act accordingly.

Grape peronospora or downy mildew, brown rot, and gray rot.—The fungus causing these diseases is known to botanists as *Peronospora viticola.* It attacks the leaves, young wood, flowers, and fruit. On the leaves it usually manifests itself first in the form of greenish yellow or brownish spots on the upper surface, while on the lower side corresponding parts are covered with a white frost-like growth. As the disease progresses the frost-like patches may disappear, leaving only the brown leaf, which soon dries up and falls off. Young wood and flowers are affected in much the same way, but owing to their structure the downy or frost-like stage is more pronounced. This form of the disease is known as the downy mildew, and in some sections it causes the only serious damage. On the fruit the fungus occurs in two forms, causing what is known as brown and gray rot. The former disease as a rule does

not make its appearance until the berries are nearly grown. At this time a brownish purple spot will appear on one side of the berry and in a short time the whole fruit is involved, turning brown and ultimately becoming soft and wrinkled. The skin usually remains unbroken until the berry drops to the ground, which it does at the slightest touch or jar. In gray rot the fruit is covered with the same frost-like growth seen on the leaves. The berries are literally plastered together with the fungus, the effect being so peculiar and so different from any other disease that no one will fail to recognize it.

Powdery mildew.—This usually appears about midsummer, attacking the leaves, young wood, and berries. Occasionally, however, it appears earlier in the season and in such cases is often very destructive to the flowers. It forms on the various parts attacked a powdery, mealy growth, this being very marked on the leaves, where it is usually more abundant upon the upper surface. The berries attacked often crack, exposing the seed in a very peculiar manner. Upon close examination of any part of the vine affected with powdery mildew, fine, delicate threads which make up the vegetative portion of the fungus may be seen. This in itself is enough to distinguish the disease from downy mildew, the only malady for which it is likely to be mistaken.

Black rot.—Black rot is so widespread and well known that it is hardly necessary to describe it. It may be well, however, to call attention to the fact that the disease usually appears first on the leaves and young shoots, causing reddish brown or blackish spots. Ten or fifteen days later the berries are attacked, the first evidence of this being a black or brownish spot at one or more points on the surface. Soon the whole berry turns brown, then black, and finally becomes hard and leathery, but as a rule clings firmly to its stalk.

Anthracnose.—Like the downy mildew and black rot, anthracnose attacks the leaves, growing shoots, and young berries.

Leaves, when first affected with the disease, show minute blackish brown spots, which are surrounded with a slightly raised, darker-colored margin. Ultimately the centers of the spots turn gray, and not infrequently the diseased parts crack across or separate from the surrounding healthy portions, leaving the leaf full of small, ragged holes. On the shoots, the disease manifests itself in much the same way as it does on the leaves. As it progresses, however, the spots usually become darker at their center, and often run together, forming more or less elongated diseased areas which gradually eat their way into the wood. The scars made in this way may often be seen on the ripened wood, and it is now known that the mycelium or body of the fungus passes the winter in the tissues surrounding these places.

Anthracnose on the fruit, or bird's-eye rot, as it is sometimes called, first appears as a blackish or brown circular spot, surrounded by a narrow, somewhat darker rim. As the spots increase in size the color undergoes various changes. In some cases the outside rim remains dark brown, while inside of this is a wider zone of a beautiful vermillion color surrounding a grayish center. Frequently the spots, when less than one eighth of an inch in diameter, assume a grayish-white color, which they retain throughout the rest of their growth. When the berries are small the disease often manifests itself in another way. The fruit turns brown, shrivels up, and, at the same time, little pinkish pustules appear on the

surface. The grape may also develop unequally, the affected side being flattened.

This form of rot is not characterized by a softening of the tissues, as in the case with others we have mentioned. The tissues slowly collapse, but at the same time become hard and wrinkled.

Believing that the foregoing remarks will, after a little study, enable anyone to recognize these various diseases, we will next direct our attention to the remedies and their preparation.

REMEDIES AND THEIR PREPARATION.

Experience has shown that for all practical purposes there are but four fungicides worthy of consideration in this connection: (1) The simple solution of copper sulphate; (2) the Bordeaux mixture; (3) the ammoniacal solution of copper carbonate; and (4) eau celeste. Of course there are other preparations which bid fair to be fully as valuable as any of the preceding, but as yet we do not know enough about them to recommend their extended use unqualifiedly.

1. *Simple solution of copper sulphate.*—This is prepared in the usual way by simply dissolving 1 pound of the copper sulphate in 25 gallons of water.

2. *Bordeaux mixture.*—The only formula now generally used is that containing 6 pounds of copper sulphate and 4 pounds of lime to 22 gallons of water. For many reasons we find it advantageous to use powdered copper; still, when time is not an important element, the crystals answer just as well and, as a rule, are from 2 to 3 cents cheaper per pound. In our work we usually provide ourselves with three barrels, one of which we divide in the middle, making two tubs holding 22 gallons. One of the barrels we use for water, which is obtained at the nearest well, clear stream, or pond. Twelve pounds of copper sulphate are weighed out and placed in one of the tubs, 6 or 7 gallons of water are added and the copper stirred in this until the water is blue. This blue solution is then poured into the empty barrel and 6 or 7 gallons more of water are poured into the tub containing the copper and the latter is stirred as before. This process is repeated until all of the copper is dissolved, it being found that 16 or 20 gallons of water are necessary for this purpose, providing crystals are used and the water is cold. Powdered copper sulphate requires much less labor and water to dissolve it, and for this reason we prefer it to the crystals. All of the copper being dissolved, 8 pounds of lime are slaked in one of the tubs. After slaking, enough water is added to make a rather thin whitewash, then this is poured slowly into the barrel containing the copper solution. We usually strain the whitewash through a coarse gunny sack, having the latter stretched over the head of the barrel. The straining removes all of the small pieces of lime, sticks, straws, etc., which have a tendency to clog the nozzle. After pouring in all the whitewash, more water is added until the barrel is filled to within 5 inches of the top. The solution is then thoroughly stirred, when it is ready for use.

Of course, the above process can be variously modified as occasion may require. Instead of hauling the water to the vineyard it may be found more convenient to prepare the mixture near the water supply and then convey it where it is to be used either in barrels or tanks made for the purpose.

In one or two parts of the country, notably central Virginia, it is claimed that Bordeaux mixture of the above strength is apt to injure the foliage of some varieties, especially Norton's Virginia. The only way we can account for this is that the soil and climate of these regions is such as to render the vines more susceptible to the action of fungicides, or else that proper care is not exercised in the use of these preparations. It is more likely, however, that the trouble is due to climatic influences, and if this is the case it becomes necessary to reduce the amount of copper somewhat. Around Charlottesville, Va., grape-growers are using a formula containing from 2 to 3 pounds of copper sulphate and 1½ to 2 pounds of lime to 22 gallons of water very successfully. We would not recommend the use of this formula, excepting in the very rare cases where the vines appear to be injured by the stronger mixture. In this connection it might be well to say that injury has sometimes resulted to the vines from the use of the Bordeaux mixture made with air-slaked lime. In all cases it is best to use *fresh* lime, but when this can not be readily obtained it would be well to use 5 or 6 pounds of the air-slaked lime for each 6 pounds of copper.

3. *Ammoniacal solution of copper carbonate.*—(*a*) In an ordinary water pail dissolve 5 ounces of copper carbonate in 3 pints of aqua ammonia, having a strength of 26°. If three pints of ammonia are not sufficient to completely dissolve the copper, add enough to bring about this result. When completely dissolved, pour the solution into a barrel and fill the latter with water.

Ammoniacal solution of copper carbonate. (*b*) Mix thoroughly 6 ounces of pulverized ammonia carbonate and 1 ounce of copper carbonate. Keep in an air-tight vessel, and when ready for use dissolve in 10 gallons of water.

This preparation is not as expensive as the preceding; moreover it has other advantages, namely, ease of preparation, portability, etc. When only a few acres are to be treated the chemicals might be obtained ready mixed, put up in air-tight cans. A 5 pound can, sufficient for 100 gallons of the solution, put up in this way should not cost over 50 cents. Buying the chemicals in quantity and mixing them at home will reduce the expense considerably. A further reduction will result if the copper carbonate is made at home according to directions which are given further on.

4. *Eau celeste.*—Dissolve 2 pounds of copper sulphate in 6 or 8 gallons of water. When thoroughly dissolved add 3 pints of strong ammonia and dilute to 50 gallons. Last season we prepared and sent out a mixture for trial which, in some cases, gave very good results, so far as its fungicidal properties were concerned. It has the same objection as eau celeste, namely, that it is not safe to use it on tender foliage. The mixture consists of equal parts of ammoniated copper sulphate and ammonia carbonate. It was put up in air-tight cans and for use was simply dissolved in water at the rate of 1 pound to 25 gallons. The solution thus obtained is practically the same as eau celeste made in the usual way. One pound of the mixture costs 45 cents, making it more expensive than eau celeste prepared according to the old formula. The only advantage the mixture possesses is that it enables those who may wish to use the eau celeste in small quantities to do so without going to the trouble of buying the copper sulphate, aqua ammonia, etc., and mixing them.

(5) *Eau céleste, modified formula.*—Dissolve four pounds of copper sulphate in 10 or 12 gallons of water. Add 3 pints of strong ammonia, dilute to 50 gallons, and add 5 pounds of common washing soda. Stir thoroughly and the solution is ready for use.

This is one of the oldest fungicides, having been used first in 1887. It rarely injures the foliage, and for this reason is much more desirable than the simple eau céleste. The ammoniacal solution has, however, about superseded these preparations in the treatment of nearly all plant diseases.

Convenient measures.—It is often inconvenient to take scales into the field; moreover, when they are at hand it requires considerable time to weigh out the various chemicals used. If the following facts are remembered it will frequently save time and trouble:

	Quarts.
6 pounds of copper sulphate, crystals	2¼
6 pounds of copper sulphate, powdered	2
4 pounds of lime, unslaked, in pieces the size of pigeons' eggs	2½
4 pounds of lime, slaked	3

A convenient measure for the copper carbonate may be made from a baking powder can or something similar. First weigh the can, then put in 5 ounces of the chemical and mark the place. We have 1-ounce, 2-ounce and 5-ounce cans made in this way, and find them exceedingly useful and labor-saving.

Manufacturing copper carbonate.—In this connection, and before proceeding with the directions for treatment, it may be well to call attention to the fact that if desirable the copper carbonate can be manufactured at home at about one third the price usually charged for it in the wholesale markets. Following are directions for manufacturing it:

In a tub or barrel dissolve 6 pounds of copper sulphate in hot water. In another suitable vessel dissolve 7 pounds of sal soda in hot water. When the two solutions are cool, pour the second slowly into the first; then add water until the tub or half barrel is full. Stir the solution thoroughly and let it stand for 24 hours, then siphon off the clear liquid and add fresh water. Stir again, and again allow the solution to stand 24 hours; siphon off the clear liquid as before, then remove and dry the sediment, which is carbonate of copper. Using the above quantities of copper sulphate and sal soda there will be formed 3 pounds of copper carbonate. Sal soda sells at wholesale for 1½ cents per pound, so that on this basis the necessary chemicals to make three pounds of copper carbonate will cost 46½ cents, or 15½ cents for one pound. The usual wholesale price for this chemical is 40 cents per pound.

TREATMENTS.

Downy mildew, brown and gray rot.—Use either the ammoniacal copper carbonate solution, eau céleste, or the Bordeaux mixture, preferably the first on account of its being cheaper and not so likely to injure the foliage. Make the first application about the time the berries are well formed, which, as a rule, is 10 or 12 days in advance of the mildew. Repeat the sprayings every 12 or 15 days, or more often if there are frequent heavy rains, until the berries begin to color. In some sections where the mildew is unusually severe it may prove advantageous to make one or two sprayings after the fruit is harvested in order to insure perfect ripening of the wood.

Eau céleste is now largely used in the treatment of this disease in northern Ohio, especially on the islands of lake Erie. In this climate it does not seem to injure the foliage at all, but this can not be said of any other section so far as we know.

Powdery mildew.—The fungus causing this disease succumbs readily to treatment with any of the copper compounds.* Where the disease exists alone we would recommend the use of the ammoniacal copper carbonate solution. In regions where the mildew is common the vines should be carefully watched, and at the first sign of the trouble, applications should begin and be repeated at intervals of 12 or 15 days. Excepting on the Pacific coast there are comparatively few regions where this disease exists alone, and of course where it is associated with any of the other maladies mentioned in this paper one treatment will answer for all.

Black rot.—Four general methods of treating this disease are now practiced by us, as follows:

1. In spring, after the vines have been pruned and before the buds begin to swell, spray the wood with the simple solution of copper sulphate. About the time the leaves are one third grown apply the Bordeaux mixture. Repeat the latter treatment when the vines are in full bloom and thereafter at intervals of 10 or 12 days until the fruit begins to ripen.

2. Omit the spraying with the simple solution, but for the rest follow the rules laid down in No. 1.

3. Treat exactly the same as No. 2, except use the ammoniacal solution instead of the Bordeaux mixture.

4. For the two first treatments apply the Bordeaux mixture the same as in No. 2, then for the rest of the season use only the ammoniacal copper carbonate solution.

In regard to these various methods it may be said that No. 1 is objectionable on account of the additional cost of the treatment with the simple solution. In the majority of cases it is doubtful if these early applications do any real good; still in an old vineyard which has never been treated, it may prove beneficial by destroying many of the dormant spores. Method 2 is probably the most reliable of all, as it has stood the test of several seasons and has never failed us, no matter how favorable the weather is for black rot and other diseases. It is more expensive than either No. 3 or No. 4, moreover the mixture by spotting the fruit may render it unfit for market. The plan outlined under No. 3 last season gave fully as good results as any of the others. It possesses the advantage of being cheap and requires no special apparatus to carry it out. The last method, or No. 4, has no particular advantages over the others unless it be that it allows the use of the Bordeaux mixture at a critical period without danger of spotting the fruit. All things considered we should advocate for an ordinary season either No. 3 or No. 4, but if heavy rains are frequent we would recommend that the Bordeaux mixture alone be used.

Anthracnose.—This disease rarely occurs alone. As a rule it is found associated either with black rot or mildew, and when this is the case no additional treatment can, in the present condition of our knowledge, be recommended. For anthracose alone the only remedy that has given any beneficial results is the Bordeaux mixture, applied in the same manner as recommended for black rot.

General treatment.—In many parts of the country it is a common thing to find downy mildew, black rot, and anthracnose all working together. In such cases the question has arisen as to whether we could not devise some general treatment which would hold all of these maladies in check. Experi-

*This does not refer to Vinifera stock.

ence has shown that any of the treatments recommended for black rot will do this providing the anthracnose is not unusually severe.

METHODS OF APPLYING THE REMEDIES.

It is of the utmost importance that the remedies reach all the green parts of the vine. These do not need to be drenched; on the contrary they only require a thin film of the fungicide to protect them against infection. It is only possible to obtain this even distribution by means of careful work and the use of suitable spraying pumps and nozzles. It is next to useless to resort to watering cans and old brooms as many do, although this treatment is perhaps better than none at all. At the present time every gardener, farmer, and fruitgrower should own a spraying machine of some kind. There are so many in the market and they can be obtained so readily that it is useless to mention any particular styles. Where one has only a few vines one of the ordinary brass syringes sold by florists for $1.50 will answer. For medium-size vineyards, *i. e.*, 10 to 20 acres, the knapsack form of pump provided with spraying nozzles is a most excellent machine. These pumps are now largely used in vineyards where the ground is uneven or where it is difficult to get in with the large horse-power machines. The prices of these pumps complete range from $14 to $25; they are sold now by nearly all reputable agricultural implement dealers. For large vineyards where the ground is level large machines may be used. Machines of this kind are made which will spray an acre in 30 minutes, requiring the labor of two men, two horses and a boy to manage them.

A very convenient machine, suitable for large vineyards, can be rigged up at home, the materials necessary being a barrel, a strong force pump having two discharge pipes, two pieces of three-quarter-inch hose each 16 feet long and two spraying nozzles. This outfit complete need not cost over $15. The apparatus is placed in a wagon or cart, which is drawn by a horse. A boy manages the horse while one man remains in the wagon or cart and works the pump; two more men follow behind using the nozzles and spraying two rows at a time. When such a machine as this is used it will keep two men busy preparing the fungicide.

COST OF THE TREATMENTS.

The cost of the treatments will depend in a large measure upon the kind of spraying apparatus used and prices paid for chemicals. With a good spraying machine and chemicals obtained at wholesale figures it is safe to estimate the total cost of treating, say an acre of bearing grapes, with the principal remedies six times, as follows:

		Cents.
Bordeaux mixture	per vine	3
Ammoniacal solution	do	2
Bordeaux mixture, two sprayings; ammoniacal solution, four sprayings	do	2½
Additional expense of spraying with simple solution of copper sulphate	do	⅛

These figures are based upon the fact that the chemicals are purchased at the following usual wholesale prices:

		Cents.
Copper sulphate, crystals	per pound	6
Copper carbonate	do	40
Aqua ammonia, 26°	do	8
Ammonia carbonate	do	11
Lime	per bushel	30

It requires on an average three quarts of liquid per vine for the season's work of six applications. Taking the foregoing as a basis, we will, to be more explicit, estimate the cost of treating an acre of bearing vines, assuming that the rows are 10 feet apart and the vines are eight feet apart in the row. This will give 544 vines to the acre. Multiplying by ¾ will give us 408, the number of gallons required to treat an acre. Four hundred and eight gallons of the Bordeaux mixture will cost as follows:

Copper sulphate, 111 pounds, at 6 cents	$6 66
Lime, 74 pounds	50
Total	$7 16

With an ordinary knapsack sprayer it will require about 92 hours of labor to make six applications in the proper manner. Estimating this labor at 10 cents an hour we have $9.20. Adding this to the cost of chemicals brings the total up to $16.36. This amount divided by 544, the number of vines to the acre, gives practically 3 cents. These figures, we believe, will enable any one to answer such questions as may arise in connection with this part of the subject, taking it for granted that the labor for each liquid is the same.

CONCLUDING REMARKS.

Under this heading we wish to call special attention to the importance of early treatment, and the absolute necessity of always bearing in mind that the work is wholly preventive. The man who waits until mildew or black rot has a fair start in his vineyard, before beginning the fight, might probably just as well pour his fungicides on the ground for all the good it will do his vines.

There is no longer any question as to the efficacy of these treatments, as is evidenced by the fact that thousands of grape-growers are now adopting them and are saving in consequence all the way from 50 to 90 per cent. of their crop. As the matter now stands, success rests wholly with the one who plans and carries on the work.

One other matter in this connection seems worthy of attention, and that is this: It should be the aim of every fruitgrower to keep his plants in health whether they are bearing fruit or not. If they do not bear fruit this year they will in all probability do so the next. For this purpose it is necessary that they shall have stored up sufficient material to properly mature the fruit, and this is made possible only by the presence of vigorous, healthy foliage. Spray, therefore, if it will save the foliage, for there is no doubt that the little expended in this way will, in the end, yield a handsome profit.

EXTRACTS FROM REPORT OF THE POMOLOGIST FOR 1891.

THE FRUIT CROP OF THE YEAR.

The fruit crop of the year 1891 was remarkably large. Apples have not only been very abundant, but owing to the scarcity last year of fruit in which insects breed, and to the increased use of insecticides and fungicides,

they have been unusually free from the depredatious of insects and fungous diseases.

Peaches have also been very abundant over nearly the whole of the peach-growing regions. In Connecticut a late frost cut off almost the entire crop when in bloom, and the same thing occurred in some portions of North Carolina, Georgia, and Ohio and in the southern counties of the Chesapeake peninsula, which has long been considered the most important of all the peach-producing sections. Furthermore, in the northern counties of this peninsula yellows made sad havoc late in the season, when it was thought that a crop of over 8,000,000 bushels was secure. The fruit ripened prematurely, and in many orchards where thousands of bushels hung on the trees not a peach was gathered. From this district less than 4,000,000 bushels were sent to market. In the famous peach region of Michigan, especially in Berrien, Van Buren, Allegan, Oceana, and Benzie counties, a large crop was gathered, and yellows did but little damage, owing to the rigid enforcement of a wise state law that requires the destruction by fire of all diseased peach trees as soon as discovered. Where formerly this dread malady ran riot in Berrien county, Mich., there is now rarely a sign of it, and the peach industry is again becoming profitable.

The pear crop was so large in some of the central states that there was barely a market for the supply. In Massachusetts, New York, Pennsylvania, Missouri, and California the crop was heaviest. In the south, where the Le Conte has proven so profitable, the "fire blight" has been making inroads, and there is danger that this variety, which for a time was thought to be exempt from the disease, may yet prove to be equally subject to it with other kinds.

The plum, both the native and the foreign, has also borne well. The variety known as Wild Goose was in every market during the early part of the season, and California soon flooded the east with the large foreign varieties. Kelsey, the largest of the Japanese plums, was noticed on the fruit stands, having been shipped from California and Florida. It may be shipped with little damage, owing to its firm flesh. Specimens from Ocean Springs, Miss., measured 3 inches in diameter. New York had the heaviest plum crop for many years. The states of Washington and Oregon take the lead in the production of plums of large size and excellent flavor. Specimens of 2, and even 3 inches in diameter are not uncommon in the eastern parts of those states.

Grapes have also been abundant; from Maine to Florida and from the Atlantic to the Pacific the crop has, with a few local exceptions, been heavy. The valleys of Utah, Arizona, and New Mexico and the southern parts of Texas and Florida are beginning to produce the same kinds that are grown in California—Muscats, Tokays, etc.—and may be expected to compete soon with that state. Western and central New York produced immense quantities of such varieties as the Concord, Worden, Delaware, Niagara, and Catawba. Northern Ohio sent to market a large crop of Catawba, Delaware, and other kinds. Florida is becoming known as being earliest in the grape market, and Texas, Georgia, and the Carolinas next. There is now no gap in the grape market from June until spring, for the later kinds are easily kept all winter in the cold-storage houses. Good grapes have sold at retail in many of the large cities for less than 2 cents per pound.

The orange crop was not so large as was expected, owing to sharp frosts

in Florida and California, but there was a liberal supply. The exportation of this fruit to England has begun, and a line of steamers between Jacksonville, Fla., and Liverpool is being established to carry the freight. Mexico, on the other hand, has begun to ship oranges to this country, and our growers may therefore look for competition from this direction.

Another citrus fruit that is becoming quite popular is the pomelo. Hitherto its cultivation has been almost wholly confined to Florida, but California is now trying it. Specimens received from Oroville were of fair quality, but in competition with that produced in Florida this fruit is likely to be at a disadvantage because of its thicker peel and more acid flavor. These objections are sometimes made even to the Florida fruit, though it is very wholesome and, to most persons, of agreeable flavor. The market demand is steadily increasing, and seedling varieties are being named and large orchards of budded trees are being set in Florida. It is to be regretted that the names "grape fruit" and "shaddock" are applied to the pomelo, as they are neither appropriate nor absolutely correct.

Of the small fruits, the strawberry was abundant in all sections, and prices ranged low except for very choice lots. The same is true of the blackberry, raspberry, gooseberry, and currant. In some localities frost, insects, and fungous diseases worked slight damage. The cranberry crop has on the whole been quite good, especially in the New England States and in New Jersey, where favorable conditions increased the crop about 17 per cent. above that of last year. In the west damaging frosts occurred in the spring and also in July, August, and September, which caused a decrease from last year's crop of 83 per cent. According to the statement of the American Cranberry Growers' association, the crop in the United States this year has been 702,250 bushels, against 800,000 last year.

Nut trees of all kinds bore a heavy crop. As a rule, the wild walnuts and hickories bear full crops only on alternate years. Last year there were very few and this year there have been many. Our native nuts are rarely found in cultivation, but the interest in nut culture is growing, and especially in the pecan, which is probably the best of all nuts, either native or foreign, which are found in our markets. The improved varieties of this nut were mentioned in my report of last year. In California there is a lively interest in the culture of the Persian walnut. This nut has often been incorrectly called "English walnut" and "Madeira nut," but recent investigations prove the name "Persian" to be the correct one. All over the country there is a slight interest in the culture of foreign chestnuts, but there is great need of more extensive plantings. Our markets are poorly supplied, and the price is therefore high for these and other nuts which should become a common article of food here as in southern Europe. Already a much larger import trade is carried on than our farmers should permit, and we trust that the tide of trade in nuts will in time be turned the other way, as is now the case with raisins, oranges, and canned fruits.

FRUIT-FARMING IN SOUTHERN MISSOURI.

In the middle of August I had the privilege of personally examining the southern part of Missouri with reference to its capabilities for producing fruit. Special attention was given to the Olden fruit farm in Howell county. The berry crops were all harvested before my arrival, but the fields of thrifty plants and records of market returns gave evidence of a large yield of strawberries, raspberries, and blackberries. I have never

seen more healthy and vigorous plants of these fruits. While it is not the purpose of the management to grow berries except as a means of furnishing steady employment to the farm hands, there is a good profit in their culture. A cannery has been built on the farm, and when there was little profit in shipping the fresh fruit to market, which is principally Kansas City, Mo., and Memphis. Tenn., it was canned at home and sent to market as occasion required. The Hopkins has here proved the best of the black raspberries, as it is not only very early but exceedingly productive. Among blackberries the Snyder, Taylor, and Ancient Briton have given better returns at Olden than all others.

A few acres are set to pears, and although the trees are young and consequently small and the blight had made inroads, there was a fair crop. Bartlett had paid the best.

There are now about 500 acres set to apples, and the trees being only from one to six years old, the crop was light, but many of them were loaded with large and handsome fruit. Ben Davis is the favorite market variety, but Jonathan and Minkler are also highly prized.

The chief crop at Olden this year consisted of peaches. At the time of my visit (August 14) about 25,000 bushels had been gathered, and there were about 25,000 bushels yet on the trees. There were nearly 400 acres in bearing. It has rarely been my privilege to see specimens so large and handsome or to taste any so richly flavored as those produced here. The whole crop averaged remarkably high in all these characteristics. There were scarcely any culls or second-grade fruit, owing partly to a thorough thinning when the fruit was about half grown. The quality was also improved by this method. The price obtained was 50 cents per bushel for everything sound and over $1\frac{1}{4}$ inches in diameter, delivered in half-bushel picking-baskets at the packing shed. This practically included the entire crop, for only a few chance seedlings and windfalls were excluded. These and any that were too soft to be shipped were saved by the cannery, which stands within a few rods of the packing house and near the railway station on the farm. The seeds of such were also saved and the parings fed to hogs, so that really nothing was lost. Enough picking-baskets were on hand to allow packing to be done directly from them without delay or rehandling. The very early varieties, such as Amsden and Alexander, had been planted in a small way only, and that by mistake, and were not gathered, as they were considered too poor either to send to market or to can.

The St. John was the first to go to market, and Mountain Rose soon followed. Family Favorite was one of the next to ripen, and gave most satisfactory returns. The Mrs. Brett and Susquehanna were handsome and of good quality, but were scant producers and not considered worthy except for amateur cultivation. Elberta was in full bearing during my visit, and in every respect stood about best. It is rather above medium in size, oval in shape, of a rich lemon-yellow, with enough blush to make it showy, and is of most excellent flavor. It bears well and ships well. Altogether, no peach before the public has more good points and scarcely any other is so thoroughly reliable in almost every way.

Another of the very profitable varieties is Gold Dust, a yellow cling of medium size, round and regular in shape, and very firm in flesh. The color is very attractive, being dark yellow with a very red cheek. It bears heavily and carries to market with very little damage. Coming as it does before the main peach crop is gathered, it is about the first yellow cling of

any special value, and therefore finds a ready sale. Each year it gains in favor, but as it is a variety having but recently originated at Kansas City, and rarely planted elsewhere than at Olden, the public know little of it. Oldmixon Free and Bonanza are two of the very best of the white and red free-stones, and are largely grown at Olden. Henrietta, Salway, Columbia, and Wilkins were also extensively planted; but being late they were not in condition to be examined except as to their productiveness, and in this respect they were up to the standard. Wilkins is a white cling, which is equal to the old favorite Heath cling in quality, and larger, and which after years of trial has practically supplanted that variety. Peach-growing at Olden is certainly a success, and other large orchards are being planted in southern Missouri. The main advantages are cheap land that is of sufficient fertility, a climate usually exempt from damaging frosts, cheap, reliable labor, and along the railroads good facilities for sending the crop to market either fresh, evaporated, or canned.

STRAWBERRY CULTURE IN EASTERN VIRGINIA.

There being large interests in strawberry culture in the tidewater section of eastern Virginia, my assistant, Mr. W. A. TAYLOR, was sent to visit the farms near Norfolk and Portsmouth the second week in May. In most of the strawberry-growing districts of the United States other fruits also are grown for shipment. About Norfolk no other fruit than the strawberry is grown in any quantity, as the climatic and soil conditions are not favorable to general fruitgrowing. The principal business is the growing of truck crops; mainly potatoes, cabbage, kale, spinach, etc.

The method of strawberry culture followed here is such as will best fit into a general system of double cropping, where commercial fertilizers are the main dependence of the trucker to keep up the fertility of the soil. The soil of the region is a shallow, sandy loam, underlaid with clay. It was originally covered with a thick growth of small pine. It is naturally warm, moist and easily drained, though very flat and only a few feet above sea level.

The method followed by most northern strawberry growers requires the exclusive use of the land for one full year before the first crop of fruit is secured. This requires a considerable outlay for labor in cultivation and hoeing, for which there is no immediate return. In such a climate as that of tidewater Virginia, where winter is but cloudy and rainy weather, interspersed with light snowfall and only occasional frosts, the cost of the cultivation and hoeing necessary for the narrow rows and clean culture of the Northern method is even greater than at the North. Late frosts in spring, which frequently destroy at least the early bloom (owing to distance from market only the early fruit is profitable), would thus cause the loss of the labor and money expended during the previous year and increase the risk in a line of fruitgrowing that is at best quite hazardous.

These causes, in connection with the experience of the truckers in growing and handling other perishable crops to meet the Northern demand for garden products out of season, explain the reason for the development of the system of strawberry culture now followed by leading growers near Norfolk.

The Norfolk Method.

Strawberry plants are set out in April, in rows midway between the rows of growing potatoes, cabbage, or other truck crops. The rows are

commonly 4 to 6 feet apart, with plants 18 to 24 inches apart in the row. The surplus of fertilizer applied to the truck crop is commonly sufficient to give a luxuriant growth of foliage and runners. The cultivation and hoeing of the former, if the soil is reasonably free from seeds of noxious weeds, leaves very little labor necessary in the strawberry rows previous to the harvesting of the truck crop. This, in the case of potatoes and cabbage, occurs during May and June. Cultivation of the strawberries is then kept up until midsummer, the cultivator being gradually narrowed as the rows widen by the rooting of runners. Runners are never cut off nor torn up, so that by the time cultivation ceases the rows are matted beds of plants and often 4 or 5 feet in width. After cultivation ceases a growth of grass and weeds springs up. This is cut down with the mower and left for a mulch. Sometimes, when it consists of "crab-grass," this is raked off and used for hay, though cleaner fruit is secured by leaving it to cover the ground and prevent the fruit from being beaten into the sand. Early in the spring, before the opening of the blossoms, a dressing of "strawberry guano" containing about four per cent. of ammonia and five to six per cent. of potash is often applied. This is sowed broadcast and left for the rains to wash into the soil. Spring cultivation is not practiced.

The aim of the grower is to secure early, clean, and firm berries that will stand shipment to distant markets. It is claimed by the growers that the matted row yields earlier and firmer fruit, and the berries are certainly cleaner than those grown by the narrow row or hill system, unless great care is taken in mulching.

Commonly only one crop of berries is taken, the fields being plowed as soon as the berries are off and a crop of corn or millet secured the same season, or else they are fitted for the planting of a fall crop, as kale or cabbage.

Varieties.

After a test of all the early ripening varieties, the Hoffman has been selected as the one best suited to the Norfolk and Portsmouth growers. Probably 90 per cent. of the entire strawberry acreage of the region in 1891 was planted to this variety. One 80-acre field was visited that contained no other, and in many fields of 20, 40, or 60 acres the same condition exists. Every early berry that is introduced is tested, the two leading new ones fruiting this year being Westbrook and Michel. Neither of these promises to take the place of Hoffman. The chief points of excellence in Hoffman are the earliness, firmness, and good color of its fruit, combined with a vigorous plant, holding the fruit up well on strong trusses. Its defects are poor quality as a dessert fruit and only moderate productiveness.

Marketing.

When the picking season arrives, men, women, and children, mainly negroes, come from all the country round, and from cities as distant as Richmond and Washington. Two cents a quart is the price for picking, and at this rate the pickers earn from 60 cents to $1.25 per day. Payment is made by means of tickets, which are cashed at stated times. Hand-carriers made with board ends, and with bottom, top, and one side of veneer, the other side being left open for taking out and putting in the quart

baskets, are used by the pickers to carry the fruit from the field to the packing shed, located conveniently near. This carrier holds 6 baskets, is light and strong, and protects the picked fruit from sun and light showers, a point often overlooked by northern berry-growers.

The shipping season begins about May 1 and continues till May 15 or 20. Fruit is often found on the plants later than this, but after the early berries are ripe near the northern cities shipments from Norfolk cease to be profitable. The shipping case in most common use is the "return" crate with hinge top, holding 60 quart-baskets packed in four layers. These layers are separated by slat-strengthened veneer division boards that prevent the injuring of the fruit and insure good ventilation. A 32-quart "gift" crate finds favor with some shippers, and the demand for this style of package seems to be increasing.

Transportation, both by water and rail, to Washington, Baltimore, Philadelphia, New York, and Boston is convenient, speedy, and cheap. No attempt is made to cool the fruit in transit. The water rate to New York this season did not exceed 1 cent per quart. Sales varied from 6 to 14 cents per quart wholesale in the Northern cities for the bulk of the crop, and netted the producers about two thirds of the wholesale price. The average yield per acre, as estimated by leading growers, is about 2,000 quarts, and at the prices obtained this year the strawberry crop is profitable.

The method practiced by the truckers is probably the safest and most profitable one for them, as it lessens the amount of capital invested in an uncertain crop and gives the early and clean fruit needed to secure good prices when Norfolk berries are in the market. A modification of this method may be found profitable in other sections of the country, where the rainfall is sufficient to carry two growing crops during a portion of the season.

MEETING OF THE AMERICAN POMOLOGICAL SOCIETY.

The twenty-third biennial session of the American Pomological society was held in Washington in September. The meeting was held September 22–25, in the lecture room of the national museum.

This society has numbered among its members the foremost pomologists of the country, and many important advances in the improvement of our fruits have been placed on record at its biennial meetings. Its reports on the nomenclature and value of varieties are everywhere regarded by fruit-growers as the highest authority on those subjects. Through its published reports and fruit catalogues it has done more to condense and make available to the general public the existing information on methods of culture and adaptation of varieties to particular localities, etc., than any other single agency. The fruit catalogue of this society is as yet the only reliable compilation of varieties that applies to the various fruitgrowing regions, and its wider circulation among farmers and fruitgrowers would do much toward preventing the annual waste of thousands of dollars' worth of fruit trees and plants put out every year by planters who have not sufficient knowledge of the varieties adapted to their localities.

The attendance at the meeting was good. Most of the states east of the Mississippi and many west of it, including California, were represented. The programme of essays and addresses included papers on a wide range of topics, arranged under three general heads, viz, scientific

pomology, commercial pomology, and miscellaneous papers on pomological topics. While limited space will not permit more than a mere mention of many of the papers, brief references to some of them may not be out of place in this report.

At the opening session, after the call to order by President BERCKMANS, the address of welcome was delivered by Hon. EDWIN WILLITS, assistant secretary of agriculture. He referred briefly to the remarkable advances made in the improvement of our fruits since the organization of the society, in 1848. At that time California and Florida were unknown as fruit-producing regions. The orange, the lemon, the fig, the Japanese persimmon, the pomegranate, the pine-apple, the olive, were essentially luxuries, imported from foreign shores. The tomato, though tempting to the eye was, in many localities distasteful to the palate, if not positively injurious. The strawberry was yet, in a large measure, only a product of the meadows.

"But it is useless," he added, "to enlarge in illustration of the condition at the date of your organization. A complete revolution has been wrought. In this revolution you, gentlemen, and those whom you succeed and whom you represent have been an important factor. The improved methods you have brought about; the new varieties you have propagated and introduced; the new fruits you have brought from foreign lands and made popular; the assiduity with which you have studied soil, and climate, and adaptability; the genius you have shown in discovering and devising new strains of flavor and of increased production; the sacrifices you have made and the fortunes you have spent in the endeavor to secure a hardy stock with the most acceptable qualities, all have been recorded, and will be gratefully remembered by generations who enjoy the luscious pleasures you have brought to their repasts. Many of your names have been household words for years. You have given joys that never satiate and sweets that never pall. Where before an improved fruit was so rare that it was a benefaction, now there is such an abundance that one can hardly discriminate and can hardly distribute his appreciation." The speaker then referred at some length to the work of the department of agriculture in lines affecting pomology, and invited the hearty coöperation of the society, that still better work might be accomplished.

In response to a request from the president, Hon. C. L. WATROUS of Des Moines, Iowa, thanked the secretary of agriculture for the kind invitation and cordial reception tendered the society. He referred to the successful work of the department and to the feeling of assurance on the part of the society that the work would be continued. He expressed it as his opinion, based on observation of the different plans adopted by various governments, for promoting the interests of agriculture, that in no other country has a government department devoted itself so successfully to securing the welfare of the common people. Referring to the work of members of the society from beyond the Mississippi, he spoke of recent attempts to perfect and develop the hardy wild fruits of the west and the prospect of success in that line of pomological work.

In the address of the president, Mr. P. J. BERCKMANS, attention was called to the fact that the official recognition of the society by the secretary of agriculture gave it "as truly a national standard in name as it has always had in deeds."

One of the objects of the society is to educate the people concerning fruits. Though not so stated in the constitutional clause defining their

duties, much of this work devolves upon the vice-presidents for the various states. The biennial meetings of the society are not sufficient to accomplish its work. The progress of pomology will largely depend upon the personal efforts of the vice-presidents and members in the several states. By personal intercourse and correspondence, the fruitgrowers of the various counties and localities should be aroused to the importance of organizing and supporting state, county, and local societies. These can hold more frequent meetings, and by discussion and comparison the merits and demerits of fruits may be ascertained. Annual reports to the state society, of which these local societies should be auxiliaries, would enable the chairman of the state fruit committees to make more reliable reports than can be obtained where state and local societies do not exist.

Though the society was founded to advance the interests of the science of pomology and can not recognize individual interests, the wonderful advance in the production of fruits makes it necessary that commercial fruitgrowing shall receive due attention. Commercial fruitgrowing as it now exists is in a measure the result of the scientific work of this society.

Discussing the causes of recent decline in the prices of fruit, President BERCKMANS said that in many cases they are local, and therefore general remedial measures can not be suggested. He mentioned the following as among these causes:

(1) Overproduction in some localities.

(2) Irregularity in transportation, which prevents daily shipments and causes an accumulation of the ripe fruit for several days.

(3) The shipment of larger quantities to a market than it can consume.

(4) Inferior quality or faulty packing, which prevents ready sale and decreases the price of similar fruit of a better grade.

The remedies suggested were the adoption of rules by local societies concerning the grades of fruit to be shipped; the appointment of inspectors, if necessary, to inspect the fruit before shipment; and the packing and shipment under the official brand of the society, indicating the name and grade of the fruit in each package.

Fungous diseases and injurious insects are increasing in some sections with alarming rapidity. In combating these the fruitgrower must call in the aid of the scientist. He should, however, acquire all possible knowledge of entomology and kindred sciences to enable him to intelligently observe the appearance and effects of these enemies, that he may aid in the work of investigation, the results of which, thanks to the government, are placed within the reach of all.

Concerning the fruit catalogue and its revision Pres. BERCKMANS said:

The aim of the official catalogue of the society is to present a list of fruits that have proved of value in the largest area of the states in which they are now rated. This catalogue was begun twenty years ago and has received much careful revision at each biennial session, but it is to-day not giving as much information as is necessary. This is because of the difficulty of so dividing our immense territory as to show the geographical and climatic regions wherein many of our popular fruits become modified to a greater or lesser extent and their value greatly changed. Several plans were suggested when the work was at its inception; and that of dividing into subdistricts such states as included regions of great difference in climate, elevation, etc., was carefully considered. This latter plan would have been adopted but for the voluminous tabulation necessary to show the rating of the fruits for the various sections. The present form was considered to be the best one then practicable. While insufficient in some instances, it has been retained until a better plan is suggested. This is a matter which I suggest for your consideration.

The labors of the committee on synonyms have been made more arduous by the introduction of well known sorts under new names and by the addition of other names

to those of new varieties held under a registered trade mark, in order to disseminate them without liability of legal proceedings. The originator of a new and valuable fruit should receive a just remuneration for the years of care and labor required for its production. But by applying for a "trade mark" or "registered label" he does not always retain a monopoly of the variety. This arises from the utter impossibility of indelibly impressing such a mark upon anything but an inert manufactured article. The "registered label" plan induces fraud and adds to the confusion of our nomenclature. There are doubtless other methods to secure remuneration to the originator of a new fruit which would be more effectual.

The various Japanese fruits imported by California firms are adding a most confusing and perplexing nomenclature. Local names, usually without significance, or misspelled because of the difficulty of writing in English characters sounds which to any but Japanese ears are mere murmurs, have increased this perplexity. Many new Japanese fruits have proved of great value in several sections of the United States, but the difficulty in arriving at a correct nomenclature has caused inferior sorts to be cultivated and entailed failure, when better sorts offered under similar names would have yielded abundant returns. This subject, I trust, will meet your careful consideration during the session.

Scientific Pomology.

In a paper on "The Possibility of Originating a Class of Pear Trees Exempt from Blight." Prof. T. J. Burrill of Illinois stated that in his opinion such a class of trees can be developed. He mentioned Tyson, Seckel, and Angoulême as varieties comparatively free from blight, and advocated the growing of seedlings from them in order to secure blight-proof pear trees which will furnish fruit of good quality.

Mr. E. F. Smith presented tables showing results of a three years' test of various fertilizers that have been recommended as preventives of peach yellows. His conclusion is that a practical test on a large scale, covering a period of three years, and in one of the best possible localities for such a test, has shown that chemical fertilizers (including the mixture recommended by Goessman and Penhallow) are practically worthless as a remedy for peach yellows, and has also shown that they have no efficacy even as a preventive.

Prof. B. T. Galloway briefly outlined the methods pursued in investigating plant diseases and the results accomplished during the past few years. He described the approved forms of apparatus for applying the fungicides used to prevent pear leaf blight and apple scab, and emphasized the importance of the subject to the fruitgrower. He estimated the damage to the apple crop in 1890, by scab alone, to be $6,000,000, and said that the total damage to the fruit crop of the country by such diseases as blight, mildew, leaf-blight, rot, and yellows is not less than $50,000,000 annually. In the investigations "a great many difficulties have been encountered, and while some have been overcome, others remain to be mastered."

Dr. C. V. Riley presented an instructive paper on "Recent Advances in Dealing with Insects Affecting Fruits." In this he discussed the methods of combating the plum curculio, codlin moth, red scale, fluted scale, and other injurious insects, giving the result of recent experiments on those insects. Contrary to the expressed opinions of many horticulturists, Dr. Riley questions whether more injury is done to-day to our fruits than was done fifty or one hundred years ago. In fact, it is patent that with the advances made of late years in our methods of warfare against these fruit pests, less injury relatively is done, but as the area of fruit culture increases, so does the aggregate of injury and also the number of species that we have to contend with. He warned pomologists to be on their guard against two foreign insects likely soon to appear in this country—

the peach ceratitis, a subtropical insect resembling the apple maggot, which is extremely destructive to the peach crop of Bermuda and likely to be troublesome if it once becomes established in Florida and Georgia, and the Japanese peach fruit worm, which is allied to our codlin moth, and in some seasons damages 90 per cent. of the peach crop of Japan. He suggested that provision be made for the inspection at ports of entry, of fruits and plants received from any part of the world from which we know danger threatens.

A practical and suggestive paper was that of Hon. C. W. GARFIELD of Michigan, on "Some Local Pomological Problems." The writer urged the necessity of paying more attention to local conditions in recommending varieties for planting. What succeeds in one locality may fail in another. Even on different fields of the same farm this is the case. Speaking of a case that came under his own observation, he said:

The Grand River and six miles of territory separate me from a colony of fruitgrowers, my warm friends. We meet in council; and they insist that the Gregg is a hardy raspberry, of good quality; that the Shaffer is a poor thing, unworthy of cultivation; that the Ohio has nothing to commend it, while my immediate neighbors unite with me in combating them on every point, and widely proclaim that the Gregg is tender, the Shaffer a great success, and the Ohio a model market black-cap. The dissimilar judgments are based upon conditions that are widely at variance. The Hill's Chili peach has been condemned by a whole section of our state as too poor a peach to grow, and is highly commended by another locality. Both are right. Each locality has its peculiar conditions, affecting this variety differently. The man who asks how to make his orchard bear is given counsel by another whose conditions are as dissimilar as it is possible to make them. And still the successful man *knows* he is right and gives his advice without reservation. I would not minimize the value of our national gatherings in the interest of pomology, but the man who goes a long way from home to get advice as to what varieties to plant or how to manage them is likely to be misled. His local conditions are those to be studied, and hence the need of carefully conducted experiments in our own neighborhoods.

Other interesting papers under this head were:

Cross Fertilization, Chancellor C. E. Bessey, University of Nebraska, Lincoln, Nebr.; Immediate Effects of Cross Fertilization as Affecting Quality and Commercial Value of Citrus Fruits, Rev. Lyman Phelps, Sanford, Fla.; Fruit Districts, Geologically and Climatically Considered, Prof. E. S. Goff, Experiment Station, Madison, Wis.; Heredity and Environment in Originating New Fruits, Prof. Thomas Meehan, Germantown, Pa.; Horticulture at the Experiment Stations, Prof. J. S. Newman, Auburn, Ala.; Pear Blight and Climatic Influences, G. F. B. Leighton, Norfolk, Va.; Physiological Effects of Pruning, Prof. L. R. Taft, Agricultural College, Mich.; Section *vs.* Whole Roots in Propagating the Apple, Prof. J. L. Budd.

Commercial Pomology.

Mr. J. H. HALE in an address on "How to Make Small Fruit Culture Pay," laid much stress on thorough preparation of the soil, asserting that while different soils need different treatment, thorough preparation, whether in drainage, fertilizing, or tillage, or in all of these, will be fouud profitable. In his experience in Connecticut he had found potash and phosphoric acid to be the plant foods most needed. Wood ashes, or cotton-hull ashes give the best form of potash. He uses 200 bushels of wood ashes with a ton and a half of fine ground bone per acre. As a rule, but little nitrogen is needed, as it increases the tendency to grow foliage. Some varieties will be benefited by an application of nitrogen, however, as, for example, the Marlboro raspberry—on soil where Golden Queen and Cuthbert do not need it. The Marlboro is a feeble grower and needs strengthening. Hill culture is preferred to matted rows for all small

fruits. To secure large, bright, and firm fruit, raspberry hills should not be closer than six feet, and for strong growers like Cuthbert, 7 or even 8 feet is better. Irrigation is profitable in strawberry growing, where it is at all possible. In many cases it prevents crop failures that would otherwise occur. Marketing demands much thought and study. It pays the grower to study the methods of packing to be seen in the fruit that comes to his market. Fruit of a uniform grade, nicely put up, and marked with the grower's name and address, is sure of a market. The eye of the buyer must be caught and his attention held by the superior quality and packing of the fruit. The grower's name should have a positive value in the market as the result of his persistent adherence to the policy of sending out only good fruit. The home is, after all, the best market for the American fruitgrower. Farmers, and even orchardists, have too little of small fruit on their tables. Half a bushel of fruit per day the year round can be profitably disposed of by the average family. A Connecticut farmer kept an account of the small fruit grown on half an acre of ground and used by his family last year. He charged the family with the fruit at market rates and found it amounted to $365, or more than $700 per acre. Such small fruit culture pays, not only in the money value of the product, but in the healthful outdoor habits of life which it encourages, and the hundred other ways in which a garden ministers to mental and physical health.

Mr. J. T. LOVETT discussed "New and Promising Small Fruits." Among strawberries Cloud (imp.) was recommended to the southern grower for shipment north. Michel was considered valuable on account of extreme earliness, and Lovett's Early worthy of mention. Other strawberries were characterized as follows: Lady Rusk (imp.), plant of moderate growth, evidently requiring deep, rich soil; Jucunda Improved, a strong and vigorous grower even upon sandy loam, fruit in all respects resembling closely its illustrious parent; Crawford, excellent for exhibition purposes, but demanding high culture and heavy soil; Yale, resembling Crawford, fruit firmer but not so large; Louise, fine for the amateur, but requiring high culture; Edgar Queen (imp.), resembling Sharpless, but more productive and ripening fruit better; Eureka (imp.), of the Sharpless type, more productive, but not so large; Mrs. Cleveland (imp.), very vigorous and productive, but fruit of light color, quite soft, and medium size; Waldron (imp.) has few equals in size and productiveness, but lacks firmness; Viola, apparently identical with Monarch of the West; Iowa Beauty, without exception the most beautiful strawberry he had yet grown, but how well it will succeed generally is not yet determined; Parker Earle, the most promising variety for general culture that has recently appeared, productive, large, of good quality, in firmness to be classed with Sharpless; Gandy, the latest to ripen, is large, firm, and excellent, but requires high culture. The first three varieties are early, the last one, late; the others ripen at mid season.

Of the black raspberries, Kansas and Lovett were mentioned as being early; Progress and Older as promising for second ripening, and Palmer, Cromwell, and Carman as closely resembling Souhegan. The only new red raspberry mentioned, Thompson's Early Prolific, was highly praised. Child's Japanese Wineberry, cane of strong growth and ornamental fruit, ripens at close of raspberry season, is attractive in appearance, but too soft for transportation, and too sour for most people.

Of blackberries, Early King seemed to Mr. LOVETT to possess much merit as an early sort, especially for the home garden. Others were men-

tioned as follows: Thompson's (Early Mammoth), evidently a seedling of Wilson's Early, and very like it in many ways; Minnewaski, the best substitute for Kittatinny, ripening ten days after Wilson; Lovett's Best, taking all things into consideration, the most promising of the new varieties; Child's Everbearing Tree Blackberry, or Topsy, apparently a hybrid between *Rubus cuneifolius* and *Rubus villosus*, retaining the stout, upright cane and villainous spines of the former and the large fruit of the latter, productive, late, large, soft, of good though not high quality, and not hardy.

Of currants, Mr. LOVETT had found Fay a success. He thought North Star to promise well, but not yet sufficiently tested; Black Champion, an improvement upon the old Black Naples, having berries larger and more productive; Crandall, to have some merit for culinary purposes, and to make a good jelly.

The gooseberry industry has not been successful with Mr. LOVETT, the plant having lost its leaves prematurely and failed to ripen its fruit.

Dwarf Juneberries were reported to have given considerable satisfaction at the East, the chief complaints being lack of productiveness and susceptibility to fungous attacks. The variety, "Success" is best, but is better for canning, etc., than as a dessert fruit. *Eleagnus longipes* was mentioned as an interesting fruit. It is very productive; its fruit is about three fourths of an inch long by one half an inch in diameter, tender and juicy, with one long, shapely, pointed seed in each berry, but too acid for dessert. It is a substitute for the cranberry.

Other papers under this head were: "Apple Growing Commercially Considered," Hon. F. WELLHOUSE, Fairmount, Kans.; "Commercial Peach-growing," J. F. TAYLOR, Douglas, Mich.; "Berry Culture, Profits, and Failures in Georgia," Dr. SAMUEL HAPE, Atlanta, Ga.

MISCELLANEOUS.

Concerning "Results of Recent Experiments With Small Fruits," Mr. T. T. LYON stated that the great mass of recent originations among strawberries have been accidental seedlings.

So pronounced is the popular preference for size and color that quality seems to have been almost if not wholly overlooked, till, as a rule, its importance may be said to hold but an inverse proportion to size in the varieties of today as compared with the primitive type. That the pistillate varieties are so notably abundant today, and so obviously increasing in number, may be reasonably attributed to the objectionable, though very convenient and common practice of employing pistillates in the process of reproduction from seed—a result in accordance with the universal law of nature, that like may be expected to produce like.

Of the raspberries, of the *Idæus* and *strigosus* types, Cuthbert, Golden Queen, Herstine, and Reder are among the best. Blackcaps vary but little as yet, perhaps because of their very recent introduction to cultivation. Certain varieties, such as Purple Cane, Shaffer, and a few others, possess so many characteristics in common with the black-caps as to indicate a possible hybridization, and if so, pointing to at least the possibility of even greater improvement in the same direction.

Among blackberries, but few, if any, of the improved varieties compare favorably with the wild product in regard to quality. Size and productiveness have been increased. White, light-colored, and spineless varieties have from time to time been brought to public notice, but so far few, if any such, have proved valuable, indicating at least a possibility that these variations may be due to lack of constitutional health or vigor. No variety has so far shown absolute hardiness in the open ground, and it may fairly be deemed improbable that such condition can ever be realized.

None of the recent introductions among currants surpass, if indeed they equal, in real value the oldest varieties upon our lists. The chief alleged improvement, and that a

very slight one, is increased size of fruit. A supposed hybrid between the cherry currant and the wild yellow-flowering currant of the west has recently been introduced, with no apparent evidence of such hybridization, either in the account of its origin or the characteristics of either its plant or fruit. The fruit, when cooked, is sprightly and rich in flavor, and would be eminently desirable for such purpose but for the exceeding thickness and toughness of the skin. Neither the plant nor its fruit is, so far, attacked by either insects or fungi; hence the variety may be found useful, if only as the basis for further improvement. Among gooseberries, Houghton is scarcely exceeded, except in size, by Downing and Smith, which, though reported to be natives, possess certain characteristics indicative of at least partial foreign origin. Industry and several other foreign varieties, reported to be less subject to mildew than most other foreigners, are apparently only tolerable in this respect under specially favorable conditions. The increased popular demand for this fruit has apparently drawn into public notice several novelties, some of foreign origin and others of at least partial native parentage, nearly all of which have yet to establish a reputation.

Several alleged varieties of the wild Service Berry which grows in our northern states have been recently introduced, but they can scarcely yet be said to have passed the experimental stage. Plantings have, so far, been generally of limited extent. The fruit, which ripens somewhat in succession, proves so specially attractive to the birds that its value, when planted more extensively, can scarcely be determined.

None of the species of *Vaccinium* seem to have been successfully subjected to either garden or field culture, though occasional alleged successes are reported. Apparently the most promising species for such purpose is the swamp blue-berry (*V. corymbosum*). Success has been reported (we think from New Hampshire) with one of the others (probably *V. canadense*) in field culture, by burning over the ground to destroy other growths, and thus securing a crop of this fruit after a subsequent growth of one year.

Hon. D. W. ADAMS of Tangerine, Fla., in a paper on "Pruning for Citrus and Other Fruits for Florida," took the ground that the first and inevitable result of cutting any tree is to do it a direct and irreparable injury; that pruning either root or top destroys existing balance and makes necessary a readjustment of the functions of the roots and foliage, causing a suspension of growth, and as a final result a smaller tree than if it had gone unpruned. Pruning for growth he characterized as absurd. He added:

Some prune to make trees bear well. There is no doubt it does make them bear, for it is an accepted fact that anything which threatens the vitality of a plant causes it to make an effort to reproduce its kind. The only reason, then, why pruning does make a tree bear is because it threatens its vitality. We complain loudly of the rapid increase of those hostile insects and dangerous diseases which now attack our trees and plants. In my opinion, the prevalence of both is due almost wholly to the low vitality and disarranged circulation caused by our defiance of the laws of nature. In attempting to improve upon nature we have got so far removed from her that, continually thwarted, she is unable in her own chosen and proper way to control these diseases and insects. So the duty devolves upon us—with what success, satisfaction, and profit, each can answer for himself.

Mr. MORTIMER WHITEHEAD, special agent in charge of division of agriculture "B," of the eleventh census, in a paper on "Pomology in the Eleventh Census," presented some startling preliminary figures concerning the magnitude of the fruitgrowing interest of the country.

The viticultural interest was found to cover 401,261 acres of vines, of which 307,575 acres were in bearing, producing 572,139 tons of grapes. It would require about 60,000 railroad cars to move the commercial crop of grapes in 1889. The industry represented an investment of $155,661,-150, and furnished employment to 200,780 persons. The vines are now growing that will within three years produce a crop of 8,000,000 to 10,000,-000 boxes of raisins. This is more than the present entire consumption of the country, which is about 7,500,000 boxes annually.

The peach acreage in the United States was found to be 507,736; value of produce, $76,160,400; hands employed, 226,000. Upward of $90,000,000 was found invested in peach-growing in the census year.

Concerning the nursery interest, it was found that a capital of $52,425,-669.51 is invested; 172,206 acres of land are used, and the grand total of young trees in nurseries in 1889 was 3,386,855,778. Of these, 518,016,612 are fruit trees, 685,603,396 grape vines and small fruits, and the balance nut, deciduous, and evergreen trees, hardy shrubs, and roses.

The writer stated that in the final compilation of the completed census the investment in horticultural pursuits will be shown to be more than $1,000,000,000.

For various reasons the writer urged that in the future collection of statistics everything pertaining to agriculture, including its census, should be under the control of the Secretary of Agriculture.

Other papers, either read or ordered printed in the report of the society included—

Does the Spraying of Orchards with Insecticides Pay? Prof. C. M. Weed, College of Agriculture, Hanover, N. H.

General Fruit Growing, G. C. Brackett, Lawrence, Kans.

Fruit Notes from a Canadian Standpoint, L. Woolverton, Grimsby, Ont.

Novelties in Pomology, H. E. Van Deman, U. S. Department of Agriculture.

Pomological Resources of North Carolina, Prof. W. F. Massey, College of Agriculture, Raleigh, N. C.

Small Fruit Growing in Eastern and Middle North Carolina, J. Van Lindley, Pomona, N. C.

The Grapes of Middle Virginia, Hon. Henry L. Lyman, Charlottesville, Va.

Fruits of Western North Carolina, H. S. Williams, Rockledge, Fla.

The Revised Nomenclature of Japanese Fruits, L. A. Berckmans, Augusta, Ga.

These papers, together with the discussions on them and the fruit catalogue of the society, will be found in the report of the society for the session of 1891.

The fruit exhibit, while not so large as at some former sessions of the society, was a creditable one. Specimens of a number of the newer varieties, as well as typical specimens of standard sorts, were donated by the exhibitors to the division of pomology. Wax models have been made of many of these for the working collection of the division.

BULLETINS OF THE ELEVENTH CENSUS.

Upon resolving to include in this volume an epitome of the horticultural statistics of the eleventh census, I found that there were none relating to the production of apples, peaches, pears, plums, etc. A letter of inquiry addressed to Supt. PORTER elicited the following reply:

DEPARTMENT OF THE INTERIOR,
Census Office, Washington, August 27, 1892.

DEAR SIR—In reply to your recent letter, I beg to inform you that no bulletin relative to the production of fruit, or to any other branch of horticulture other than those which you mention in your letter, has been issued by this office. The tabulation of the statistics of apples, peaches, pears, etc., has not been finally abandoned, but, if the work is done at all, it will be the very last subject of investigation to be taken up.

Very respectfully,
J. HYDE,
Special Agent in Charge of Agriculture.

To this I replied that these statistics were of much more importance than some of those already tabulated and issued in bulletin form, and I urged that the work should be done, and as soon as possible. I append Mr. HYDE'S reply:

DEPARTMENT OF THE INTERIOR,
Census Office, Washington, September 3, 1892.

DEAR SIR—Your letter of August 30 implies a fear that there is some lack of appreciation of the importance of horticulture on the part of this office, which is certainly not the case. No previous census has done anything like so much for the horticultural interests of the country as has been done by the present one. This fact has been recognized by more than one national convention. The horticultural investigation of this census was, however, laid out on a scale that was not only one of great magnitude, but, as an examination of the inclosed schedule will show you, was out of proportion to many other important interests. I do not believe that the work of the office will be brought to a conclusion without a tabulation of the statistics of the production of apples, peaches, and probably one or two other leading fruits, but the hourly demands that are made upon the office for the statistics of sheep and wool, neat cattle and dairy products, the value of farming lands, and other branches of investigation, are such as to leave the office no choice but to give matters of such widespread public interest, especially at the present time, the preference. The work of this division would be in a much more forward condition than it is had it not been that the insufficiency of last year's appropriation necessitated an almost entire suspension of work for a long period of time. Agriculture and allied subjects are now, however, occupying the attention of a larger clerical force than is engaged upon any other department of census work, and by the time the work is completed there will be no interest that can justly consider itself to have been slighted. As for horticulture being of "greatly more importance than some of those already tabulated," I would inform you that when the number of clerks available for the agricultural work of the census was so greatly reduced, it became necessary to confine the work of the division to subjects that could be handled by a small force, in order that the work might not be entirely barren of results. I write you thus fully in view of your official position as the secretary of one of the most influential of our state societies, in order that no misapprehension may exist as to the attitude of this office toward the interest you represent.

Very respectfully,
J. HYDE,
Special Agent in Charge of Agriculture.

EDWY C. REID, ESQ.,
Sec'y State Horticultural Society, Allegan, Mich.

AGRICULTURE—VITICULTURE.

Bulletin No. 38.

For the first time the census office has made a special investigation for the purpose of ascertaining the extent and value of the grape, raisin, and wine industries of the United States. The results of this inquiry, while not all that could be desired, have certainly cleared the way for future reports. An industry representing a total value in land, improvements, machinery, and appurtenances of $155,661,150, and furnishing employment to 200,780 persons, deserves a special place in the decennial inventory of the nation's wealth and resources. Unfortunately there are no reliable data by which a comparison of the growth of this important branch of agriculture can be made. Unless retarded by the ravages of those destroying insects and the fungoid diseases that have played such havoc with vineyards in some sections of the country, a still more remarkable development of viticulture may be expected, expecially in what are termed established districts.

The accompanying bulletin, relating to the culture of the vine in the United States for the production of table grapes, raisins, and wine, has been prepared by Mr. H. Gardner, special agent, under the supervision of Mr. Mortimer Whitehead, special agent in charge of the Division of Agriculture "B." It shows the location of the several grape-growing districts of the United States, with a total of 401,261 acres in 1889, of which 307,575 acres were in bearing, producing 572,139 tons, of which 267,271 tons were table grapes and 240,450 tons were used for producing wine, making 24,306,905 gallons, 41,166 tons for raisins, making 1,372,195 boxes (20 pounds each), and 23,252 tons for dried grapes and purposes other than table fruit. The material from which these exhibits have been compiled was obtained direct by the census office from the producers and by traveling special agents, and is regarded as trustworthy in every particular.

Robert P. Porter,
Superintendent of Census.

STATISTICS OF GRAPE GROWING AND WINE PRODUCTION IN THE UNITED STATES.

BY H. GARDNER.

Viticulture as an industry is comparatively in its infancy in this country. For more than one hundred years efforts were made to grow the European varieties of grape in the open air, always, however, resulting in failure, except in California. Pomologists then turned their attention to the improvement of native vines, and the result is the development of many choice and valuable varieties. It is only since these improved varieties of native grape have been planted and cultivated that the industry has become profitable and has grown to its great proportions in various parts of the country east of the Rocky mountains, while in California the foreign varieties have found a most congenial home and are grown to perfection. Viticulture was introduced in California by the Franciscan fathers before it came into the possession of the United States.

In New York state, in what is known as the lake Keuka district, a grower of grapes shipped his first crop, amounting to fifty pounds, to the

New York market about 1845 by way of the New York and Erie canal. The grapes were delivered in good condition, and the commission houses handling them wrote encouragingly to the shipper, advising further shipments. The next year the grower was able to ship some 200 or 300 pounds. He overdid the matter, however, and the New York market on grapes broke under the pressure. It is estimated that during the last season (1890) there have been shipped from this same district and carried by the different railroad and express companies to New York, Boston, Philadelphia, and other distributing markets about 20,000 tons or 40,000,000 pounds of grapes, and probably one quarter of this amount was, in addition, sold to wine manufacturers.

The Hudson river district, in the same state, is estimated to have shipped to the New York and other markets during the same time between 13,000 and 15,000 tons or 28,000,000 pounds of grapes, while the Chautauqua district of New York, where the industry has been growing and prospering only through the past decade, furnished as its 1890 crop for the different markets of the country probably about 1,200 car loads or 30,000,000 pounds of table grapes, making a grand total of 98,000,000 pounds as the product of what is known as the New York state district. This does not include the large amount of grapes used in the district for wine, the figures and report upon which will be found elsewhere in this bulletin.

As a further instance of the proportions to which the industry has grown in the United States, as will be seen by the accompanying tables, the product of California for the season of 1889 was 14,626,000 gallons of wine and 1,372,195 boxes of raisins. The product of 1890 is estimated, by schedules sent directly to the census office, at 16,500,000 gallons of wine and 2,197,463 boxes of raisins, with young raisin vineyards enough to increase the yield of raisins within the next five years to 8,000,000 or 10,000,000 boxes.

The area in which the industry may be found has been separated into five divisions, some of which are again subdivided into districts. These divisions are as follows:

First. The Eastern division, comprising about 51,000 acres in cultivation in the states of New York and Pennsylvania, includes the Keuka district, Canandaigua district, Ontario and Wayne district, Seneca district, Chautauqua county, (New York) and Erie county (Pennsylvania) district, and the Hudson River district.

Second. The Middle division, with 42,633 acres in the states of Illinois, Indiana, and Ohio, the latter including the Islands district and the Euclid district.

Third. The Western division, with 17,306 acres in the states of Kansas and Missouri.

Fourth. The Southern division, with 17,092 acres in Georgia, North Carolina, Tennessee, and Virginia.

Fifth. The Pacific division, with 213,230 acres in California, including its several districts, and Arizona and New Mexico.

Outside of these five divisions all other states and territories show upward of 60,000 acres in cultivation.

For the purposes of this investigation, the products of viticulture have been classed under three distinct heads, namely, grapes for table use, grapes for raisins, and grapes for wine.

The following table shows the area and production of vineyards, capital invested in land, buildings, etc., and labor employed in the United States by states:

Total Area and Production of Vineyards and Capital invested in the United States, by States.

States.	Area in bearing vines.	Area in non-bearing vines.	Average yield of grapes per acre.	Market value of grapes per ton.	Grapes sold for table use.	Grapes sold to wineries.	Wine made.	Market value of wine per gallon.	Raisins produced (20 lbs. to box.)	Market value of raisins per box.	Total value of plant including land.	Total laborers employed (all kinds).
	Acres.	Acres.	Tons.	Dollars.	Tons.	Tons.	Gallons.	Dollars.	Boxes.	Dollars.	Dollars.	Number.
Total	307,575	93,686			267,271	304,868	24,306,905		1,372,195		155.661,150	[a] 200,780
Arizona	1,000	1,500	3.00	16 50	2,850	150	25,000	1 00			75,000	1,250
California	155,272	45,272	1.77	17 66	38,785	[b]235,526	14,626,000	19	1,372,195	1 60	86,640,350	100,422
Georgia	1,938	2,154	1.33	96 00	1,938	646	107,666	1 15			1,227,600	2,046
Illinois	3,750	990	2.00	54 00	6,000	1,500	250,000	1 00			1,422,000	2,370
Indiana	3,850	1,000	1.75	67 00	5,390	1,347	224,500	1 00			1,455,000	2,425
Kansas	4,542	1,000	2.00	58 00	8,294	790	130,990	80			1,662,600	2,771
Missouri	10,000	1,764	3.00	50 00	22,500	7,500	1,250,000	56			4,605,600	5,882
New Mexico	1,186	9,000	3.00	45 00	1,779	1,779	296,500	86			3,055,800	5,093
New York (c)	43,350	7,650	1.75	70 00	60,687	15,172	2,528,250	50			20,400,000	25,500
North Carolina	4,000	1,200	1.75	60 00	4,667	2,333	388,833	1 00			1,560,000	2,600
Ohio	28,087	4,956	1.80	57 00	38,947	11,609	1,934,833	56			13,217,200	16,521
Tennessee	1,500	600	2.50	89 00	2,500	1,250	208.333	1 00			630,000	1,050
Virginia	4,100	1,600	2.00	60 00	5,434	2,766	461,000	1 00			1,710,000	2,850
Other states and territories	45.000	15,000	2.00	60 00	67,500	22,500	1,875,000	1 00			18,000,000	30,000

[a] It should be noted that while the average number of laborers employed in viticulture is shown to be one person to two acres, the average for those directly employed in growing the grapes is but one person to three acres, the others being engaged in the curing of raisins, manufacture of wine, transportation of products, etc.

[b] This includes for California 41,166 tons made into raisins and 23,252 tons used for dried grapes and purposes other than table fruit.

[c] Includes 1,000 acres in Erie county, Pennsylvania, known as part of the Chautauqua district of New York.

[A table showing the area and production of vineyards, capital invested and labor employed in the United States, by geographical divisions and districts, is omitted.—SECRETARY.]

EASTERN DIVISION.—Viticulture in the Eastern division is mainly confined to a few counties in New Jersey; the Hudson River district of New York state, comprising about 13,000 acres, situated in the counties of Orange, Ulster, Rockland, Putnam and Westchester; the Keuka district, of 14,500 acres, on Lake Keuka, including Yates and Steuben counties; the Canandaigua district, of 3,200 acres, comprising parts of Ontario and Yates counties bordering on Canandaigua lake; the Ontario and Wayne district, of 1,200 acres, including portions of counties of the same names; the Seneca district, with 5,000 acres, found in portions of Seneca and Schuyler counties; the Chautauqua district, of 10,800 acres, near the shores of Lake Erie, in Chautauqua county, New York, and Erie county, Pennsylvania; in addition to which Niagara and other counties of New York have vineyards aggregating 3,300 acres.

Four fifths of the grapes grown in the Eastern division are used for table purposes, the crop of 1890 amounting in round numbers to 98,000,000 pounds or 49,000 tons, and requiring nearly 5,000 cars for its transportation to market. The varieties most largely grown and generally in favor are the Concord, Catawba, and Delaware, while other market varieties are Moore's Early, Niagara, Diana, Worden, Isabella, Wyoming, and Brighton.

This division supplies the eastern markets with table grapes from early in September until the following March or April. The favorite packages are five and ten pound baskets, those put up in the most attractive manner returning the best prices. Sales are mainly made through commission merchants, although some localities have of late organized "exchanges," through which they make their own shipments and sell in a more direct manner, effecting a saving in the expense of handling and transportation. In this division, as well as in all others east of the Rocky mountains, the fungoid diseases have of late years worked great injury to the industry, and the year 1889 was a particularly disastrous one. Not only did these diseases retard the work and discourage many of the growers, but frost destroyed the buds generally (in the month of May). It was also an unusually rainy season, developing mildew and the black, brown, and gray rot, and causing a loss of at least fifty per cent.

There are in the Eastern division (in the Keuka district, in New York state) eight wine cellars, each with a capacity of from 20,000 to 300,000 gallons. Two of these carry a stock of 300,000 bottles of champagne each. There are other wine cellars in this locality making champagne in a smaller way by fermentation in the bottle.

MIDDLE DIVISION.—This division comprises the states of Illinois, Indiana, and Ohio. In Ohio the industry is mainly found on the Lake Erie islands and in the northern tier of counties bordering on the lake. To some extent, however, it exists in almost every portion of the state. The Lake Erie islands and the lake counties were personally visited in the month of September last. There are in this district, in all, 10,228 acres. The islands furnish to the markets about one half of their product for table grapes, the remainder being sent to the wine cellars. Erie county furnishes four fifths of its product for table grapes and one fifth for wine. In Cuyahoga county, embracing what is known as the Euclid district, nearly all the product is shipped to various western markets, and while this investigation was being made (about October 1, 1890) at Euclid, Cuyahoga county, the special agent saw nine car loads of grapes started on their way to Denver, Colorado, in one shipment. There were shipped from Euclid,

in all, the same season 600 tons or 1,200,000 pounds; from Dover, Cuyahoga county, 900 tons of table grapes or 1,800,000 pounds; from Nottingham, 106 tons or 212,000 pounds. There were also shipped from Vermillion, Erie county, 95 tons, mostly for wine, and from Ceylon station, Erie county, 55 tons for wine and about 25 tons of table grapes, while the Lake Erie islands furnished 4,564 tons for table grapes, and the balance of their product (1,140 tons) for wine.

As an item of interest it may be mentioned that in this district there is a monster wine cask containing 36,000 gallons, one of the largest in the world. This cask is made of Ohio oak, and is of the finest cooperage. The winery where this cask was shown has a capacity of 850,000 gallons. There are a number of large cellars on the islands and peninsula, at Kelley's island, Middle Bass, Marblehead, Toledo, and Sandusky. A small amount of champagne is made in this locality.

In the states of Illinois and Indiana, with 4,740 and 4,850 acres, respectively, and in counties of Ohio not before mentioned, with 22,815 acres, viticulture has hardly held its own during the last decade. Fungoid diseases have found the vines an easy prey in these states, and the vineyards in many localities have been practically abandoned. There are some vineyards in the Mississippi valley and in favored localities where both wine and table grapes are grown for local markets. As growers become familiar with the use of spraying apparatus and fungicides their hopes and interests are being renewed, and brighter days seem to be dawning in this direction.

WESTERN DIVISION.—This division, consisting of Missouri and Kansas, has made but little progress during the past ten years. The vineyards in Missouri, except in a few localities, have been devastated or ruined. Mr. HERMAN JAEGERS, government experimental agent for the state of Missouri, says: "In Newton county there are but 20 acres left, but this does not apply to grapes grown in gardens on most farms. From 1866 to 1875 there were several hundred acres of vineyards in Newton and adjoining counties. Most of these were grubbed up and abandoned, owing to the prevalence of black rot. Now that we are certain that we can prevent black rot and mildew with spraying, replanting has commenced, and will probably become general in a year or two more. As far as I know, the situation is similar to this all over southwestern Missouri."

For the purposes of this investigation Hermann, in Gasconade county, Missouri, was visited, but no devastation was seen in the vineyards. One of the largest and best vineyards in the state is located here, and contains 80 acres, apparently nearly all wine grapes.

Mr. MIESSNER, of Bushburg, Jefferson county, Missouri, a well-known and reliable authority, reports to this office that the ravages of the black rot did not become ruinous until 1875, when the disease developed over a large portion of the southern half of the state and resulted in the greatest damage to the grape crop of that section. Since that year black rot has been of annual recurrence, marked by more or less disastrous consequences to the grape crop. In some years the loss would be no less than half the crop, or even more, while in other seasons it would be but a small percentage, confined chiefly to varieties most subject to the disease. Mr. MIESSNER further says: "The growth of viticulture in many sections of our state has received a check. A large number of the vineyards have been abandoned. The planting of new vineyards has been reduced in some localities. Spraying the vines, as recommended by the Department of

Agriculture, with the Bordeaux mixture and Eau Celeste has been experimented with by many growers, and when applied early, thoroughly, and often enough, has given encouraging results. There is now a well-founded hope that by the intelligent and persistent use of the copper salt remedies we shall conquer the black rot, as well as the mildew, perenospora, and other fungoid diseases."

In Kansas, in this division, there have been small plantings of vines in various parts of the state, aggregating some 5,542 acres of young and old vines, raising some table grapes and making some wine for its home market. The prospects for grape-growing in the western division are improving.

SOUTHERN DIVISION.—This division includes the states of Georgia, North Carolina, Tennessee and Virginia, of which Georgia has 1,938 acres of bearing vines and 2,154 acres of new vineyards; North Carolina, 4,000 acres of bearing vines and 1,200 acres of new vineyards; Tennessee, 1,500 acres of bearing vines and 600 acres of new vineyards; and Virginia, 4,100 acres of bearing vines and 1,600 acres of new vineyards. Georgia, in 1889, produced 107,666 gallons of wine and 3,876,000 pounds of table grapes. The latter ripen early, reaching the northern markets a month earlier than those grown in Ohio or New York, and consequently bring much higher prices than the northern and western grapes. A variety that is meeting with much success in the southern states is the Niagara, a white grape, very hardy, ripening early, and doing well in Georgia. One of the evidences that viticulture is prospering in that state is shown in the extent of the new plantings, the reports to the census office showing that 2,154 acres were planted within the last two years.

North Carolina's 4,000 acres of bearing vines in 1889 produced 388,833 gallons of wine and 9,334,000 pounds of table grapes. Tennessee, with 1,500 acres produced 208,333 gallons of wine and furnished 5,000,000 pounds of table grapes. Virginia had 4,100 acres of bearing vines, which produced 461,000 gallons of wine and 10,868,000 pounds of table grapes.

Virginia during the past decade has held her own, although growers have had to fight the various enemies, such as mildew and black rot, but are thoroughly awake to the importance of using the remedies recommended by the Department of Agriculture.

This investigation has shown an extension of vineyards during the past two or three years in the state of Florida. The Elvira and Niagara have been planted somewhat extensively, and part of the Niagara product reaches the northern markets as early as the latter part of July or the first of August, bringing higher prices in consequence, selling from 25 to 30 cents per pound. The varieties mentioned are white grapes, very hardy, and may succeed.

There are in this division 11,538 acres of bearing vines and 5,554 acres of new vineyards, which produced 1,165,832 gallons of wine and 29,078,000 pounds of table grapes in 1889. The outlook for successful viticulture in the southern division for wine, and particularly for the finer varieties of table grapes grown for the early northern and western markets, is full of encouragement to the careful and earnest cultivator.

PACIFIC DIVISION.—This division embraces Arizona, New Mexico and California. Viticulture in Arizona and New Mexico is comparatively new, but is thought to have a prosperous future. Not only do the native varieties of grape grow in these territories, but the European, or vinifera, also flourishes here. The Muscat varieties, grown so successfully in Cal-

ifornia for raisins, grow equally well in those territories; also varieties that produce a fine sherry wine. This is one of the most prominent features of viticulture in Arizona. Mr. J. De Barth Shorb, a prominent vine-grower and wine-maker of southern California, after experimenting in Arizona, reports that the sherries produced there have the true sherry flavor and are made by the natural process; that is, without it being necessary to "bake" them. They not only have the flavor of the Spanish sherries, but also the same excellent qualities. So far, the fine sherries produced in this country have come from that territory. The same authority states that Arizona will be to the United States what Spain is now to Europe. There were in 1889 in Arizona 1,000 acres of bearing vines and 1,500 acres of new vineyards. The product was 2,850 tons or 5,700,000 pounds of table grapes, of which 150 tons, or 300,000 pounds were sold to wineries.

In New Mexico in 1889 there were 1,186 acres of bearing vines and 9,000 acres of new vineyards, which produced 296,500 gallons of wine and 1,779 tons or 3,558,000 pounds of table grapes. The information received from New Mexico by the census office shows a great advance in viticulture since irrigation has proven practicable. Two companies are building immense canals 45 feet wide at the bottom, capable of carrying 7 feet of water. These canals will irrigate 400,000 acres of as rich land as can be found in the world adapted to the growth of fruit and grapes. Mr. E. G. Shields, a leading horticultural authority, says: "I have tested thoroughly peaches, apricots, apples, nectarines, and French and German prunes, and am much pleased with their success. I have also planted olives. This is their third year. Reference is here made to the Pecos valley, New Mexico, which for cultivation is yet in its infancy. La Mesilla valley is next in importance. It has about 10,000 acres of vines of new plantings. The Mission variety is grown almost exclusively in this locality, although the Muscat of Alexandria and the Muscatel are grown by some. The varieties that grow successfully in New Mexico for raisins are the Muscat of Alexandria, Muscatel de Gordo Blanco, and Sultana, and for wine the Zinfandel, Mataro, Cabernet, Sauvignon, Cabernet Franc, Mission, Petite Pino, and Chasselas Fontainbleau. I feel assured that in two years there will be 100,000 acres of grapes in the Pecos valley. I have now about 20,000 vines (33 acres) in fine condition, and will add 100 acres."

The industry in New Mexico and Arizona is as yet too young to speak of its possibilities, but the start already made seems to justify all that the pioneers are claiming for it.

California.—There are fifty-three counties in California, nearly all producing grapes in a greater or less degree, the larger proportion of them producing wine for home consumption or export. There is an established demand for this wine to the amount of 1,000,000 gallons per month from this country alone, making 12,000,000 gallons annually, and an exportation to foreign countries of 311,920 gallons in 1889, valued at $217,093.

California may be divided into three grape-growing districts: The Coast, which includes Sonoma, Lake, Napa, Alameda, Santa Clara, and Santa Cruz counties; the Sierra Nevada Foothill and Sacramento Valley district, which includes Placer, El Dorado, Calaveras, Tuolumne, Yuba, Yolo, Butte, Sacramento, and Tehama counties; and the Southern district, which includes San Joaquin, Merced, Fresno, Tulare, Kern, Ventura, Santa Barbara, San Bernardino, Los Angeles, and San Diego counties.

In the first district the finer grades of white and red dry wines are made.

The choice varieties of the French and German types seem to come nearer to reproducing themselves here than elsewhere. In this district are successfully grown the finest varieties of French champagne grapes, which yield a handsome profit to the producers. There is one cellar in this district with a capacity of 800,000 bottles, producing champagne by natural fermentation in the bottle. The champagne industry in California is a growing one, and its future is bright with promise. While wine is the leading viticultural product, fine table grapes are also produced in this district.

Some good, wholesome dry wines are produced in the second district, but they are of a different character from the German and French types. Grapes for table use and raisins are extensively grown, a large portion of the new plantings being for raisins.

In the Sacramento and San Joaquin valleys, and in the Southern district, some excellent dry wines are produced, but these valleys excel in their Port, Muscatel, Angelica, and other heavy sweet wines.

For the purposes of this bulletin it is only necessary to treat of the principal counties in each district where the heaviest viticultural products are found.

In Napa county, in the first district, there are 20,763 acres. Phylloxera has destroyed many acres of vines in this county, but the acreage has been kept up to about the same point by replanting on resistant stock and the planting of new vineyards further up on the foothills, where a choice variety of grapes is grown and phylloxera is not such a scourge. There are 142 wine cellars in Napa, many of them of modern construction, containing all the appliances for the manufacture and handling of wines. There were 3,000,000 gallons of wine made in this county in the census year 1889.

Sonoma county, in this district, in 1889 had 21,683 acres of bearing vineyards. The same conditions exist here relative to the quality of grapes and wines produced as in Napa. The ravages of phylloxera were felt in Sonoma at an earlier day than in Napa, appearing about 1874, and a great many vineyards were destroyed. It is now generally believed that the destruction caused by the phylloxera can be stayed by growing the native resistant stock and grafting upon that the foreign vinifera.

In Sonoma county in 1889 there were produced about 1,756,300 gallons of wine and 250,000 gallons of brandy. The quality of the dry white wines was marked.

Santa Clara county, in this district, contains some 12,500 acres of bearing vineyards, and should enjoy a reputation for fine white and red wines equal to Sonoma and Napa. This and Santa Cruz county in 1889 produced 2,544,000 gallons of wine. As yet the phylloxera has troubled the vineyards but little in comparison with the counties before mentioned. There is said to be a deep gravelly bed underlying this whole surface, in which the growers say the phylloxera does not work with success.

Alameda county, in the first district, has 6,500 acres of bearing vines, and produces a type of wine resembling the white and red wines of France, and in this part of the district, known as the "Livermore district," a high grade of Sauterne and claret is produced. The geological formation of the valleys and slopes of the Mount Diablo range more nearly reproduce the soil conditions that characterize the department of the Gironde in France than any other section on the coast. In this district there were produced in 1889 some 60,000 gallons of wine, noted more for

the quality than for the quantity which it produces. This is comparatively a new wine district, and has grown up within the last decade. The first systematic planting of high-grade grapes began in 1882.

There is in the second district a great viticultural interest, embracing table grapes, raisins, sweet and dry wines, and brandies, excelling in the latter. Sacramento, Placer, El Dorado, Tehama, Yuba, Butte, and Yolo counties produce large quantities of table grapes, and quite a quantity of raisins is shipped from some of these counties. Tehama has the largest vineyard in the world, 3,800 acres, to which the manager says 1,000 acres of new vines are to be added within a year. There were in the distillery on this vineyard in April, 1890, when visited by the special agent of the census office, 300,000 gallons of brandy and 1,000,000 gallons of wine. Another large vineyard, the second largest in the state, contains 1,500 acres, and is situated at Folsom, Sacramento county. The winery belonging to the vineyard has a capacity of 600,000 gallons. Many table grapes are shipped from this vineyard to the eastern markets. The sales in this direction have largely increased during the past two seasons.

The third district is composed of San Joaquin, Merced, Fresno, Tulare, Kern, Ventura, Santa Barbara, Los Angeles, San Bernardino, Orange, and San Diego counties. Near Stockton, in San Joaquin county, is located one of the largest vineyards and wineries. Fine brandies are made in this district; also sherries, ports, and some excellent clarets. Fresno county contains at this time some 25,000 acres of bearing vines and 15,000 acres of new plantings, the larger portion of which is grown for raisins. There are, however, a great many gallons of wine and brandy made in this county. The wines are mostly sweet, and of excellent quality. The raisin pack in 1889 was 626,595 boxes; the wine produced, 1,200,000 gallons. The California "Wines and Vines," speaking of the Muscatel de Gordo Blanco, the true raisin grape, says: "The soil seems to impart a vigor to the vines that is unknown elsewhere in the world. The second crop is often very nearly equal to the first, and the third comes before the leaves fall off." More than half the raisin grapes grown in California are produced in Fresno county.

San Bernardino county, in this district, is also principally devoted to the growing of raisin grapes. There are 9,562 acres of bearing and 4,125 acres of non-bearing vines, and the raisin pack for 1889 amounted to 375,000 boxes. Two wineries in San Bernardino county produced 279,000 gallons of wine in 1889. There were also shipped from this district 1,700 tons of table grapes.

Los Angeles county has 18,120 acres of bearing vines. A new and mysterious disease attacked the vines of the southern portion of this district about 1885 and ruined more than one half of the acreage. Every effort has been made to discover the cause and remedy the evil. The most expert scientists have been consulted by the State Board of Viticulture in California, and the Department of Agriculture appointed an expert to investigate and report upon the matter. There were produced in 1889 in Los Angeles county 25,820 tons or 51,640,000 pounds of grapes for wine, and 1,000 tons or 2,000,000 pounds of grapes for table purposes. The wines in this county are justly celebrated, and were the first shipped from California to the eastern markets. This county excels in its sherries, ports, and brandies. There were 20,000 boxes of raisins packed in 1889, the new disease having reduced the product about one half. The product

of Orange, a county lately formed from portions of Los Angeles county, is included in the above figures.

In San Diego county there is an acreage of 6,000 bearing and 7,500 non-bearing vines. Of the latter, 6,000 were just coming into bearing in 1889, and did not add much to the product. While this shows a fair increase in the growth of the industry during the last four years, the increase is accounted for by the fact that the new disease that was so injurious in Los Angeles, did not affect San Diego county. It is in the El Cajon valley of San Diego county that the most progress has been made in viticulture. There are 27,000 acres adapted to fruitgrowing, and 3,000 acres of bearing raisin vineyards in El Cajon. The raisins from this valley are among the finest produced in California. The product of the El Cajon valley in 1889 was 75,000 boxes; in the balance of San Diego county the pack was 75,000 boxes; in all, 150,000 boxes. Another successful branch of viticulture in this district is the shipment of table grapes to the eastern markets. Many of the elevated localities are so free from frost that grapes can be left on the vines until January.

As it has been noted in this bulletin that California has the largest vineyard in the world, it may be well to state that she has also the smallest. It is a vineyard consisting of a single vine, in Santa Barbara county. It was planted by a Mexican woman about sixty-eight years ago, and has a diameter one foot from the ground of 12 inches, its branches covering an area of 12,000 feet, and produces annually from 10,000 to 12,000 pounds of grapes of the Mission variety (many bunches weighing six and seven pounds), the crop being generally made into wine. The old lady who planted this one-vine vineyard died in 1865 at the age of 107.

Viticulture, already a great industry in the Pacific division, promises to become still greater in the near future.

The census investigation of viticulture shows that outside of the regular districts already mentioned there are probably 45,000 acres of bearing and 15,000 acres of non-bearing vines, an aggregate of small vineyards from one fourth of an acre upward, grown to supply a home demand for this healthy and delicious fruit and a like demand for wine. This class of vineyards is to be found in every state and territory of the Union, producing, in 1889, 67,500 tons of table grapes and 22,500 tons of wine grapes, or 1,875,000 gallons of wine. These small plantings are more or less experimental, and, when proven a success in a small way, will doubtless lead to larger enterprises. In localities where the industry has thrived in past years, and has been abandoned on account of mildew and black rot, now that the United States government, through its Department of Agriculture, is so successfully experimenting in regard to the causes of the diseases and the remedies to be applied to save the vines, and the favorable results are being known, a new interest is being manifested, and, no doubt, when another decade has passed, the grape industry will be again successful and greatly increased in many of the now comparatively small grape-growing sections.

AGRICULTURE.—TRUCK FARMING.

Bulletin No. 41.

For the first time the industry known as truck farming has been made a subject of census investigation, and herewith is presented a preliminary report thereon, prepared by Mr. J. H. HALE, special agent, under the direction of Mr. MORTIMER WHITEHEAD, special agent in charge of the Division of Agriculture "B," of this office. The statistics are compiled from returns which have been received mainly from truck farmers, but are not as yet considered complete, and will be subject to revision for publication in the final report.

Truck farming, as considered in this report, is distinct from market gardening; the former is carried on in favored localities at a distance from market, water and rail transportation being necessary, while the latter is conducted near local markets, the grower of vegetables using his own team for transporting his products direct to either the retailer or consumer.

A summary of the number of acres under cultivation for truck-farming purposes and the value of products raised, given by districts, is herewith appended:

Districts.	Acres.	Value of products.	Districts.	Acres.	Value of products.
Total	534,440	$76,517,155	Baltimore	37,181	$3,781,696
			South Atlantic	111,441	13,183,516
			Mississippi Valley	36,180	4,982,579
New England	6,838	$3,184,218	Southwest	36,889	4,979,783
N. York and Philadelphia	108,135	21,102,521	Central	107,414	15,432,223
Peninsular	25,714	2,413,648	Northwest	1,083	204,791
Norfolk	45,375	4,692,859	Mountain	3,833	531,976
			Pacific Coast	14,357	2,024,345

Upward of $100,000,000 are invested in this industry, the annual products reaching a value of $76,517,155 on the farms after paying freights and commissions realized upon 534,440 acres of land. There are employed in this industry 216,765 men, 9,254 women, and 14,874 children, aided by 75,866 horses and mules and $8,971,206.70 worth of implements.

ROBERT P. PORTER,
Superintendent of Census.

TRUCK FARMING.

BY J. H. HALE.

The production of fruits and vegetables for market has always been prosecuted with great success, in earlier days as a branch of general farming, and more recently as a specialty, known as market gardening. The business is usually carried on with a few highly enriched and thoroughly cultivated acres of ground and a rotation of crops, so grown that there may be a daily supply throughout a considerable portion of the year. The

farms are usually within a reasonable driving distance of cities and towns, and the products are generally sold to the retailer, and in many cases, especially in the smaller towns, directly to the consumer.

Truck farming, although it also consists in the production of green vegetables for market, is distinguished from market gardening by the fact that, while the market gardener lives near a market and delivers his products with his own teams, usually producing a general variety of vegetables, the truck farmer lives remote from market, is dependent upon transportation companies and commission men for the delivery and sale of his products, and usually devotes himself to such specialties as are best suited to his soil and climate.

Previous to 1860 truck farming was an infant industry, unknown except to a very limited extent along the steamboat and railway lines leading out fifty miles or so from a few of the larger northern cities. Long Island, New Jersey, Delaware, and southern Illinois appear to have been at that time the leading truck centers of the country.

The rapid growth of cities and towns, however, and their consequent demand for a greater quantity and variety of vegetables throughout the whole year; the changed condition in the south after the close of the war, and the extending of old and building of new lines of railway, all combined to extend the business, until a very considerable portion of the vegetables consumed in cities and towns are produced from five hundred to fifteen hundred miles away. Instead of having vegetables in their respective seasons, by drawing upon the various sections of the country, nearly all the standard vegetables are produced throughout the year. Late in the fall and early in the spring Florida and the lower Mississippi valley supply the eastern and central cities and California those of the far west and mountain section, until the advancing season, at the rate of about thirteen miles a day, starts the growth and consequent supply up along the Atlantic coast and the great Mississippi valley, when the full season of midsummer in the north continues the supply until autumn frosts once more compel a return to the south, where a fresh crop awaits the demand of the market. While throughout the year California, out of her abundant store, sends products to her own large cities and those of the Rocky mountain region, and even as far east as Denver, Kansas City, Saint Louis, and Chicago, the greenhouses of New England in early winter and spring supply the more tender vegetables that do not well withstand the deterioration of transportation, or are profitable enough to pay for the extra expense of their culture under glass. New potatoes, cabbage, cauliflower, garlic, and tomatoes have thus far been about the only products received at St. Louis, Kansas City, and Chicago from California, and these only in limited quantities in seasons when there has been a partial failure in the lower Mississippi valley and Florida. During December and February of the present winter superb tomatoes came from California and sold at prices that left a small profit to the grower, after paying the enormous express charges that must of necessity be charged for so long a haul; but, with the further development of railways, faster trains and lower freight and express rates, that state will be in a position to compete sharply for much of the trade beyond the Mississippi, for, besides the natural fertility of a soil that will grow almost every vegetable to perfection, she has a climate where winter vegetables are not likely to be occasionally cut off by frost, as in the south.

Nearly 75 per cent. of the truck produced in the United States comes

from a belt of country along the Atlantic coast lying east of a line drawn from Augusta (Maine) to Macon (Georgia); from southern Georgia, Alabama, and Florida; along the north and south lines of railroad in the Mississippi valley from the Gulf to Chicago, Saint Louis and Kansas City, and from the celery districts of Michigan and Ohio. As more or less truck is produced in all the states, it has been thought best, for the purposes of this bulletin, to divide the country into districts, as follows:

First. New England district: the field crops supplying Boston and other New England cities, and the greenhouse products supplying all the large cities of the East.

Second. New York and Philadelphia district; New York state, Long Island, New Jersey, and Pennsylvania, which contributes largely to the New York and Philadelphia markets.

Third. Peninsular district: Delaware and the eastern shore counties of Maryland and Virginia, which supplies all the northern and some of the central west markets.

Fourth. Norfolk district: eight southeastern counties of Virginia, and eight northeastern counties of North Carolina, which largely supplies northeastern and central western markets.

Fifth. Baltimore district: western Maryland, West Virginia, and that part of Virginia not in the peninsular and Norfolk districts, largely tributary to Baltimore, Washington, and northern cities, as well as local canning factories.

Sixth. South Atlantic district: North Carolina, South Carolina, Georgia and Florida, supplying northern markets, east and west.

Seventh. Mississippi Valley district: Alabama, Mississippi, Louisiana, Tennessee and Kentucky, tributary to north central and northwestern cities.

Eighth. Southwest district: Texas, Arkansas, Missouri, and Kansas, largely tributary to Saint Louis and Kansas City.

Ninth. Central district: Ohio, Indiana, Illinois, Michigan, Wisconsin, Iowa and Nebraska.

Tenth. Northwest district: Minnesota, North Dakota, and South Dakota.

Eleventh. Mountain district: Idaho, Wyoming, Utah, Nevada, Colorado, New Mexico, and Arizona.

Twelfth. Pacific Coast district: California, Oregon, and Washington.

On the truck farms of the United States, in 1889, by the labor of 216,765 men, 9,254 women, and 14,874 children, aided by 75,866 horses and mules, working $8,971,206.70 worth of implements, upon 534,440 acres of land, valued at $70,156,293.59, there was produced truck valued at $76,517,155 on the farms after paying freights and commissions.

The following table shows the total acreage of leading vegetables grown upon truck farms of the United States:

Vegetables.	Acres.	Vegetables.	Acres.
Total	534,440	Beets	2,420
		Celery	15,381
		Cucumbers	4,721
Asparagus	37,970	Watermelons	114,381
Beans (string or snap)	12,607	Other melons	28,477
Cabbage	77,094	Peas	56,162
Kale	2,962	Sweet potatoes	28,621
Spinach	20,195	Tomatoes	22,802
Irish potatoes	28,046	Miscellaneous vegetables	82,601

The business being very largely the creature of transportation companies, the leading trucking centers are consequently along the lines of through railways or those having easy communication with the various large centers. which are nearly always distributing points for this class of produce. The South Atlantic states and southwest Michigan have also

been greatly aided in their development by superb steamer accommodations. From Norfolk, Virginia, there are lines of ocean steamers to Philadelphia, New York, Providence, and Boston, which dispatch from fifteen to eighteen large steamers per week loaded with truck during the height of the season; besides, there are daily lines to Baltimore, Washington, and Richmond, that carry large quantities of truck among their miscellaneous cargoes.

Charleston, Savannah, and Jacksonville also have a large fleet of steamers that two to four times a week land enormous quantities of truck at New York and Boston, while from southwest Michigan ports daily steamers of small size land their truck in Chicago by thousands of barrels and boxes.

Of the vegetables grown by truck farmers, the leading classes are as follows: Watermelons, cabbage, peas, asparagus, melons other than watermelons, sweet potatoes, tomatoes, spinach, Irish potatoes, celery, and string beans, ranking in acreage in the order named. Beets, cucumbers, cauliflower, carrots, eggplant, kale, lettuce, lima beans, parsnips, radishes, rhubarb, squashes, sweet corn, and turnips are also grown as truck farm crops, but only to a limited extent as compared with the first named, these and other vegetables not here mentioned being grown mostly by market gardeners rather than by truck farmers. (*a*)

In each class there are a few leading varieties that prove most satisfactory all over the country, while others are sectional in their habits, either on account of soil or climatic conditions. Old and well-tried varieties are continually being discarded for various causes and new ones are constantly coming to the front; the more progressive truck farmers have, therefore, little test plats, where old and new varieties are tested side by side and the results noted.

The agricultural experiment stations in some states have also taken up the matter of seed and variety tests.

The following table gives the acreage by districts of leading vegetables grown:

Number of Acres of Leading Varieties of Vegetable grown, by Districts.

Districts.	Asparagus.	Beets.	Snap or string beans.	Celery.	Cabbage.	Cucumbers.	Kale.	Watermelons.	Other melons.	Peas.	Irish potatoes.	Sweet potatoes.	Spinach.	Tomatoes.	Miscelleneous.	Aggregate.
Total	37,970	2,420	12,607	15,381	77,094	4,721	2,962	114,381	28,477	56,162	28,046	28,621	20,195	22,802	82,601	534,440
New England	242	83	65	443	1,586	272		210	645	1,476	427		310	305	774	6,838
New York and Philadelphia	6,592	864	2,710	4,058	41,054	870	110	7,320	7,223	9,446	2,361	4,660	3,262	6,990	10,615	108,135
Peninsular	2,640	67	615	97	3,275	313	590	2,469	1,160	3,224	1,295	4,860	2,128	416	2,565	25,714
Norfolk	1,973	116	1,098	130	9,790	285	878	2,974	1,784	5,858	3,305	3,187	5,965	525	7,507	45,375
Baltimore	2,270	134	585	198	4,165	360	261	620	475	5,170	2,860	3,150	1,980	3,780	11,173	37,181
South Atlantic	14,090	766	3,465		3,309	1,265	690	55,726	1,102	12,899	5,850	3,133	1,838	2,986	4,322	111,441
Mississippi Valley	2,323	144	1,376	46	2,816	354	240	6,069	1,343	5,879	4,071	1,160	1,590	3,170	5,599	36,180
Southwest	1,719	60	1,875	313	2,730	894	170	8,098	2,238	3,281	3,602	3,725	1,378	2,918	3,888	36,889
Central	5,864	186	818	9,812	6,103	108	23	28,771	12,210	7,555	2,845	4,556	1,744	1,362	25,457	107,414
Northwest	135			150	400					60				60	278	1,083
Mountain	12			18	496			390	18	90	840				1,969	3,833
Pacific Coast	110			116	1,370			1,734	279	1,224	590	190		290	8,454	14,357

The following table gives the number of acres planted, value of land, number of persons employed, and value of implements used:

Number of Acres in Truck-farm Crops, by Districts.

Districts.	Acres planted.	Value of land per acre.	Total land value.	Men employed.	Women employed.	Children employed.	Horses and other animals employed.	Value of implements used.
Total	534,440		$70,156,293 59	216,765	9,254	14,874	75,866	$8,971,206 70
New England	6,838	$317 91	$2,173,868 58	7,718		185	3,468	$355,361 20
New York and Philadelphia	108,135	226 11	24,450,404 85	68,964		1,378	26,232	3,566,594 25
Peninsular	25,714	98 75	2,539,257 50	10,748	760	890	3,641	496,936 00
Norfolk	45,375	135 50	6,148,312 50	17,815	2,258	2,416	5,790	876,316 00
Baltimore	37,181	97 50	3,625,147 50	13,210	1,450	1,690	5,265	778,094 00
South Atlantic	111,441	45 25	5,042,705 25	31,650	2,716	3,950	6,686	374,568 00
Mississippi Val.	36,180	62 51	2,261,611 80	13,920	886	1,375	2,995	287,487 50
Southwest	36,889	57 86	2,134,397 54	11,170	834	1,020	2,731	117,215 00
Central	107,414	159 91	17,176,572 74	33,695	350	1,970	16,456	1,782,624 00
Northwest	1,083	104 51	113,184 33	1,465			240	22,380 00
Mountain	3,833	98 50	377,550 50	1,445			595	44,245 50
Pacific Coast	14,357	286 50	4,113,280 50	4,965			1,767	269,385 25

THE LABOR QUESTION.

This is an important question to the truck farmer, labor not being employed throughout the year. Except in a very few instances transient help must be used very largely, especially in gathering the crop, and on this account, in connection with the advantages of better shipping facilities, the southern truck farmer locates in close proximity to large cities and towns, to which the negroes of the south, especially the younger ones, generally drift. In the truck section about Norfolk, Virginia, there are employed 6,000 men and boys throughout the year, and for six weeks in the height of the shipping season 22,489 men, women, boys, and girls are kept at work, some coming from Richmond and other interior cities of the state and some from North Carolina. While many of them work by the day or week, much of the truck is gathered by piece work; so much per row, dozen, bushel, box, or barrel.

On every truck farm of any considerable size some men are employed throughout the year who are more or less experts as propagators, cultivators, or packers. These men are paid from $300 to $600 per year and board at the north and west and on the Pacific coast, and about $100 more where a house is furnished them and they board themselves.

The following table shows the number of men, women, and children employed in each trucking district:

Number Employed in each Trucking District.

Districts.	Men.	Women.	Children.
Total	216,765	9,254	14,874
New England	7,718		185
New York and Philadelphia	68,964		1,378
Peninsular	10,748	760	890
Norfolk	17,815	2,258	2,416
Baltimore	13,210	1,450	1,690
South Atlantic	31,650	2,716	3,950
Mississippi Valley	13,920	886	1,375
Southwest	11,170	834	1,020
Central	33,695	350	1,970
Northwest	1,465		
Mountain	1,445		
Pacific Coast	4,965		

The following table shows the average wages, without board, paid men, women, and children in the various districts; also the piece price paid for harvesting a few of the leading vegetables, returns received on this latter point being somewhat meager. Final reports may show a slight variation from these figures. Very little piece work is done except at the south.

Average Wages Paid in each Trucking District.

Districts.	Men per day.	Women per day.	Boys and girls per day.	Picking string beans per bush.	Cutting and trimming cabbage per bbl.	Gathering kale per bbl.	Picking peas per bush.	Digging and assorting potatoes per bbl.	Picking tomatoes per bush.
New England	$1 25		$0 65	$0 10			$0 15		
New York and Philadelphia	1 19		50	12		$0 05	15		
Peninsular	75	$0 50	35	12	$0 06	05	20	$0 12	$0 03½
Norfolk	75	50	35	10	05½	05	20	10	04
Baltimore	77	50	25	15	06	05	20	10	03
South Atlantic	85	65	35	12	06	04½	20	12	04
Mississippi Val.	75	50	25	12	06½		18	12	04
Southwest	1 01	50	25	10	06½		20	12	03½
Central	1 16	62	50				15		
Northwest	1 15								
Mountain	1 40								
Pacific Coast	1 35								

The figures in the following table are based upon special reports received from leading truck farmers in the various districts. Wages are somewhat higher in Florida than in other southern states, thus advancing the average for the south Atlantic district considerably above the other districts employing negro labor.

Labor Cost Per Acre on Leading Varieties of Vegetable in Each Trucking District.

Districts.	Asparagus.	Beets.	String or snap beans.	Celery.	Cabbage.	Cucumbers.	Kale.	Watermelons.	Other melons.	Peas.	Irish potatoes.	Sweet potatoes.	Spinach.	Tomatoes.
New England	$34 27	$75 00	$42 00	$58 00	$36 25	$137 50		$24 00	$37 50	$29 37	$16 00		$37 00	$75 00
N. York and Philadelphia	36 46	18 50	35 00	44 62	26 28	16 00	$23 15	14 29	26 60	26 47	16 25	$10 00	14 29	30 00
Peninsular	21 60	20 25	11 25	16 90	18 60	14 50	21 75	12 50	10 75	10 00	13 00	11 00	15 50	26 50
Norfolk	18 33	22 50	12 50	17 50	19 70	15 00	23 50	13 33	11 85	10 18	12 00	13 00	15 72	27 15
Baltimore	19 00	22 75	13 25	16 75	20 50	15 50	24 75	16 40	12 50	11 25	13 75	12 75	16 75	31 25
South Atlantic	21 25	12 50	8 07		15 95	6 50	24 60	7 10	7 91	10 25	16 40	10 00	13 25	22 50
Mississippi Valley	16 00	21 50	21 00	17 00	17 23	18 50	19 00	9 40	17 75	16 00	14 75	12 00	15 50	29 66
Southwest	13 91	22 00	20 00	51 66	13 82	30 00	20 00	9 59	8 25	15 06	12 50	15 00	6 32	36 60
Central	31 11	23 25	25 00	52 71	22 20	16 00	21 00	12 30	15 92	18 67	13 50	12 50	15 55	40 60
Northwest	32 00			80 00	15 55					18 00				50 00
Mountain	35 00			95 00	24 00			13 70	17 10	19 90	16 75			
Pacific Coast	33 00			87 00	19 50			12 60	14 90	16 45	14 10	13 00		31 60

The greatly increased labor cost on beets in New England is accounted for by the fact that some of the planters first start the plants in greenhouses in early spring, then transplant them into 2½ inch pots, and finally into the open field as soon as the weather will permit, all of which greatly adds to the labor cost. Cucumbers, also, being so largely grown under glass in this district, adds greatly to their cost. The increased labor cost of some other vegetables in the New England district is accounted for by the difficulty of cultivating the soil, and the fact that labor is more scarce and therefore commands a higher price, while in most of the other districts the soil is easier tilled and labor more abundant, colored persons being mostly employed.

SEEDS AND PLANTS.

For the ordinary farm crops the seeds and plants are very largely of home or neighborhood production, while on the truck farm so much more time and attention has to be given to the details of growing and marketing that but little attention is given to seed growing. Consequently the seed trade finds among truck farmers their largest and best customers.

The following table shows the cost of seeds and plants per acre for the various crops, the difference being caused largely by the lack of uniformity in prices and by difference in quantity of seed used, and, again, by the few reports on this subject received from truckers in some of the districts. More complete returns may make a slight change before printing the final reports.

Cost of Seeds and Plants per Acre in each Trucking District.

Districts.	Asparagus plants. [a]	Asparagus seed. [a]	String or snap beans.	Beet seed.	Cabbage plants.	Cabbage seed.	Celery plants.	Celery seed.	Cucumber seed.
New England	$19 00	$1 00	$2 50	$2 00	$15 00	$1 03	$15 00	$0 96	$0 50
New York and Philadelphia	15 27	1 00	2 60	1 31	10 50	1 06	16 50	1 00	50
Peninsular	21 00	50	3 00	3 00	10 50	65	12 75	1 00	60
Norfolk	19 00	62	3 00	2 50	11 00	75	15 00	1 00	50
Baltimore	24 00	75	3 00	3 00	12 50	50	16 00	1 00	60
South Atlantic	16 40	1 00	3 32	3 75	5 75	1 00			90
Mississippi Valley	16 00	1 00	4 60	2 50	7 45	1 25	12 50	85	1 00
Southwest	16 87	75	3 00	2 50	11 12	1 44	12 00	1 00	1 00
Central	15 53	75	3 00	2 50	9 88	81	9 85	89	60
Northwest	17 50	1 00			6 00	90	13 33	75	
Mountain	20 00	1 25			8 00	1 00	12 50		
Pacific Coast	14 00	85			6 00	75	12 00	85	

[a] Cost of seeds or plants for the asparagus is not an annual expense, for when a field is once established it is permanent.

Cost of seeds and Plants per Acre in each Trucking District.—Continued.

Districts.	Watermelon seed.	Other melon seed	Kale seed.	Peas.	Irish potatoes.	Sweet potatoes.	Spinach seed.	Tomato plants.	Tomato seed.
New England	$2 00	$3 00		$6 00	$6 50		$1 55	$14 00	$0 40
New York and Philadelphia	1 20	1 43	$2 50	7 75	10 33	$7 50	1 73	10 00	75
Peninsular	75	1 10	3 00	5 40	8 50	5 00	1 34	9 00	65
Norfolk	75	1 00	2 60	6 50	8 00	6 00	1 50	10 00	50
Baltimore	75	1 00	2 50	6 00	9 00	5 75	1 40	12 00	50
South Atlantic	85	1 32	2 50	7 40	12 00	8 00	1 40	13 00	95
Mississippi Valley	90	1 33	2 50	7 00	12 00	7 25	1 55	16 33	1 25
Southwest	86	1 26	2 50	7 77	13 00	5 83	1 75	15 00	1 05
Central	98	1 18	2 50	6 63	6 00	5 50	1 62	16 25	1 00
Northwest				7 50				16 00	1 00
Mountain	1 25	1 75		8 00	7 00				
Pacific Coast	1 00	1 25		7 50	6 00	5 00		8 00	75

FERTILIZERS.

As the largest and finest vegetables can only be grown upon land in a very high state of cultivation, and maturity is also hastened by liberal feeding, the question of fertilization is one to which the truck farmer has had to pay close attention, especially at the east and south, where the soil is not as fertile as at the west and on the Pacific coast. Market gardeners near cities and towns absorb nearly the full supply of stable manure, and as stock feeding is not carried on to any considerable extent in connection with truck farming, commercial manures are necessarily the main dependence of the truck farmer, especially at the south. In the intelligent use of these manures farmers have been greatly aided by the agricultural experiment stations established in the various states. Special manures are now compounded for feeding the various crops. Potatoes and other root crops are supplied with a fertilizer rich in potash and phosphoric acid and only a moderate supply of nitrogen, while foliage crops, notably cabbage, celery and spinach, are given a fertilizer very rich in nitrogen and a smaller proportion of the other essential elements of plant food.

The principal raw materials used in the manufacture of special manures are as follows:

First. Containing nitrogen as the chief valuable ingredient: nitrate of soda, sulphate of ammonia, dried blood, cotton-seed meal, castor pomace, dried fish, dried flesh.

Second. Containing phosphoric acid as the chief valuable ingredient: dissolved bone black, phosphatic guano, acid phosphate (rock), dissolved raw bone, ground raw bone.

Third. Containing potash as the chief valuable ingredient: high-grade sulphate of potash, muriate of potash, kainit (cotton-hull ashes.)

Fourth. Containing nitrogen and phosphoric acid: bone manure, tankage, dry ground fish scrap.

The work of agricultural experiment stations, and the frequent popular bulletins issued by them and by the United States Department of Agriculture, have materially aided the truck farmer to a more intelligent understanding of the question of plant food and plant feeding, so that now on many large truck farms there are mills and machinery for the home mixing of fertilizers, the raw materials being bought in carload lots and any required mixture made to supply the demands of various soils and crops. However, more than 80 per cent. of the commercial manures used are purchased by truckers all mixed and ready for immediate use. An application of 1,500 pounds per acre on each of the 407,130 acres of truck farms of the east and south of a fertilizer costing on an average $30 per ton absorbed $9,160,425 of truck farm money in 1889.

In the New England and New York and Philadelphia districts very liberal manuring is practiced, while at the south but a comparatively small quantity of manure is used. In the central west, whatever food has to be furnished the soil and plants is mostly supplied by stable manure. The Mountain and Pacific Coast districts report using so little manure that it has not been possible at this time to arrive at any average of cost; in fact, it can almost be said that for the present they require little or no manure on most of the lands to produce satisfactory crops, especially when there is an abundance of water for irrigation.

The cost per acre of fertilizers for the leading varieties of vegetable is given in the following table, the figures being based upon special reports received from leading truck farmers in the various districts:

Fertilizer Cost Per Acre for Leading Varieties of Vegetable.

Districts.	Asparagus.	Beets.	Snap or string beans.	Celery.	Cabbage.	Cucumbers.	Kale.	Watermelons.	Other melons.	Peas.	Irish potatoes.	Sweet potatoes.	Spinach.	Tomatoes.
New England	$52 78	$40 00	$30 00	$92 89	$67 85	$30 00		$21 00	$23 00	$40 00	$50 00		$65 17	$60 00
N. York and Philadelphia	31 64	40 00	14 00	42 50	31 25	28 00	$30 00	24 42	23 50	27 18	24 50	$15 50	31 59	15 00
Peninsular	19 20	30 00	12 50	65 33	31 00	28 00	26 33	13 70	15 00	9 05	30 12	9 33	24 05	17 50
Norfolk	20 50	26 50	11 75	47 50	36 00	28 50	27 50	13 50	14 00	10 50	32 00	8 75	25 50	21 00
Baltimore	23 50	28 00	12 60	48 00	32 50	26 90	25 50	14 10	14 75	11 25	29 50	9 50	24 75	20 00
South Atlantic	25 00	16 00	7 25		22 75	10 00	23 00	7 20	8 75	11 25	27 00	15 00	15 00	21 00
Mississippi Valley	25 50	13 00	14 33	20 00	35 72	28 33	22 00	9 87	6 31	18 87	16 45	9 00	12 00	21 20
Southwest	27 06	12 00	8 00	20 00	22 94	16 00	20 00	10 12	4 88	10 00	19 00	10 00	13 00	25 00
Central	29 59	10 00	7 50	15 28	19 89	9 75	15 00	9 15	8 88	14 72	13 00	17 50	25 83	14 50
Northwest	20 00			39 00	28 00					10 00			18 00	17 00
Mountain														
Pacific Coast														

The following table indicates average profits secured in different sections of the country:

Net Income per Acre on Leading Varieties of Vegetable.

Districts.	Asparagus.	Beets.	Snap or string beans.	Celery.	Cabbage.	Cucumbers. [b]	Kale.	Watermelons.	Other melons.	Peas.	Irish potatoes.	Sweet potatoes.	Spinach.	Tomatoes.
New England	$216 66	$200 00	a	$266 66	$183 83	$2,000 00		$100 00	$188 33	$130 00	$100 00		$175 00	$300 00
N. York and Philadelphia	183 60	150 00	a	214 41	133 37	a	a	81 66	158 81	67 00	90 00	$75 00	80 00	165 00
Peninsular	84 00	80 00	$32 00	66 00	95 00	26 00	$50 00	43 00	51 00	26 00	77 25	48 60	32 60	43 00
Norfolk	93 33	88 60	32 50	68 25	101 92	25 00	50 00	46 00	57 50	27 48	80 83	50 50	33 75	45 00
Baltimore	87 75	80 60	28 70	87 75	96 50	27 50	47 00	42 00	53 50	29 50	68 50	52 10	37 60	34 00
South Atlantic	93 63	95 00	42 94		113 61	175 00	a	32 06	55 00	57 37	101 60	106 50	70 00	94 72
Mississippi Valley	116 66	a	52 50	a	128 33	160 00	a	37 00	47 50	100 00	79 50	a	a	117 80
Southwest	121 40	a	a	150 00	154 58	250 00	a	46 30	72 90	58 00	66 50	35 00	73 00	20 00
Central	116 40	100 00	a	176 63	98 44	140 00	87 00	67 66	104 76	71 15	56 66	117 50	44 62	133 14
Northwest	160 00			225 00	81 66					87 50				60 00
Mountain	165 00			237 00	79 50			80 00	64 00	67 00	98 50			
Pacific coast	217 00			247 50	145 00			53 90	67 10	71 00	107 50	110 00		65 00

a Data as to net income not obtained.
b The enormous profits from cucumbers in the New England districts resulted from their culture under glass at great expense.

INCOME AND PROFITS.

While some truckers plant a great number of acres, but by lack of sufficient fertilization and thorough culture secure only moderate crops, which return very little, if any, profit, a large majority practice what is known as "intensive" farming, which results (except in bad seasons) in very heavy crop returns, the net proceeds of which, however, vary greatly with each season and market. The larger markets being often oversupplied with certain vegetables, or on their arrival they are found in bad condition, the consignment will sell for only enough to pay freight and cartage, and in some few instances not even enough for that, while another variety of vegetable sent to the same market on the same days will return very high prices, netting a fine profit, leaving the whole average of the business satisfactory.

The average melon fields of the South Atlantic states yield about 400 salable melons per acre. Twelve hundred will load a car, which will sell in the north anywhere from $150 to $275, leaving net returns of from nothing up to $150 per car. One gentleman in Dawson county, Georgia, reports making a net profit of $1,700 from 32 acres in 1889.

The gross income on truck farm products, after deducting commissions and charges for transportation, was $76,517,155; the cost of labor ($9,474,825.58), the cost of fertilizers ($9,919,307.89), and the cost of seeds, ($1,419,633.50) being deducted, the net income is shown to be $51,909,265.06, leaving a difference between the gross and net income of $3,794,122.97 more than is accounted for. This difference is caused by various local expenses not reported on special schedules, but no doubt is nearly all for shipping packages.

The figures of gross income ($76,517,155) are based upon those given by the regular census enumerators. Investigation through special schedules show that the income reported was in nearly every case that received from the commission men, who deducted from 15 to 40 per cent. from the gross value of products sold to pay costs of transportation and commissions on sales. Had charges for transportation and commissions been included, the total gross income would have been in the neighborhood of $95,000,000.

Taken in its entirety, this comparatively new industry is found to be in a healthy, prosperous condition. New sections are being developed from year to year that to a certain extent affect the prosperity of some of the older ones, and there is likely to be more or less shifting of trucking centers every few years, all upon advancing lines, however. New and better methods of culture, with the further invention of labor-saving machinery, must of necessity reduce the cost of production. Better transportation facilities will place the products of these farms in cities and towns more promptly, in better condition, and at less cost, while the ever-increasing population and wealth of the cities and towns insure a greatly increased consumption at satisfactory prices for first-class productions.

AGRICULTURE.—FLORICULTURE.

Bulletin No. 59.

As an industry floriculture has been for the first time made a subject of census investigation, and herein is presented a preliminary report thereon, prepared by Mr. J. H. HALE, special agent, under the direction of Mr. MORTIMER WHITEHEAD, special agent in charge of the Division of Agriculture "B" of this office. The material from which these statistics are compiled was obtained direct from the florists upon schedules specially prepared for that purpose and by personal visits of special agents to florists' establishments in all parts of the country. These figures are subject to revision before publication in the final report.

It will be noted that while floriculture has been carried on as a business in this country for upward of one hundred years, it is only within the past twenty-five years that it has assumed large proportions. Out of a total of 4,659 establishments 2,795 were started between 1870 and 1890, and of these 1,797 between 1880 and 1890. There are 312 commercial floriculture establishments owned and managed by women. These 4,659 establishments had in use in the census year 38,823,247 square feet of glass, covering a space of more than 891 acres of ground. The establishments, including fixtures and heating apparatus, were valued at $38,355,722.43; tools and implements, $1,587,693.93, and gave employment to 16,847 men and 1,958 women, who earned in the year $8,483,657. Fuel for heating cost $1,160,152.66. The products for the year were 49,056,253 rose bushes, 38,380,872 hardy plants and shrubs, while all other plants amounted to 152,835,292, reaching a total value of $12,036,477.76 for plants. Cut flowers brought an additional income of $14,175,328.01.

From the tabulations in the bulletin it appears that the largest number of square feet of glass in one establishment in the United States is in the District of Columbia; the oldest establishment was started in New York; the largest number of roses propagated were, respectively, in Pennsylvania, Illinois, and Ohio; the largest number of hardy plants propagated were, respectively, in Illinois, New York, and Kansas; the largest total value of plant sales were, respectively, in New York, Pennsylvania, and California, and the largest total value of cut-flower sales were, respectively, in New York, Illinois, and Pennsylvania.

In addition to the Society of American Florists, 965 state and local floral societies and clubs and 358 horticultural societies, aided by the agricultural and horticultural press, helped to develop this industry to its present large proportions.

ROBERT P. PORTER,
Superintendent of Census.

COMMERCIAL FLORICULTURE.

BY J. H. HALE.

While flowers and flowering plants were grown for sale to a very limited extent in this country one hundred years ago, the business of the commercial florist has made the greater part of its development during the past twenty-five years, and the larger proportion of this business the past ten years.

After inquiry of every florist in the United States, the report indicates that there was but 1 commercial florist in the year 1800, and only 3 establishments started between 1810 and 1820; 8 more were started in the next decade, 25 in the next, followed by 45 between 1840 and 1850, 96 between 1850 and 1860, 313 between 1860 and 1870, 998 between 1870 and 1880, and 1,797 between 1880 and 1890.

The dates of establishment in business of 72 per cent. of the florists have been traced, and judging from these it will be seen that 80 per cent. of the whole business has been developed during the past twenty-five years. The business being of so comparatively recent development, and never before having been brought within the scope of census statistics, there have naturally been many obstacles in the way of making a complete report. The florists have generally responded with remarkable clearness, and while some have not given all the information desired, and a few have failed to respond even to many repeated requests, it is believed that the figures given fairly represent the business at the present time.

Floral establishments were found in every state and territory except Idaho, Nevada, Indian territory, and Oklahoma, and while there is a possibility that there may be some small establishments in those places the most careful inquiry has failed to find them thus far. In the United States there were 4,659 floral establishments in the census year, 312 of which were owned and conducted by women. The total feet of glass in use in all these establishments was 38,823,247, and the establishments, including fixtures and heating apparatus, were valued at $38,355,722.43. The value of tools and implements used was $1,587,693.93. There were employed 16,847 men and 1,958 women, the combined annual wages amounting to $8,483,657. Fuel cost was $1,160,152.66. 3,425,600 wholesale and 17,630,094 retail catalogues are annually issued, while $767,438.21 was paid for postage, $1,161,168.31 for advertising, $534,221.86 for freight, and $554,390.55 for express bills.

The total products were 49,056,253 roses, 38,380,872 hardy plants and shrubs, and 152,835,292 of all other plants, the value of which was $12,036,477.76, and cut flowers to the amount of $14,175,328.01 were reported as sold.

The greatest area of glass in any one establishment reported was 150,000 square feet and the smallest 60 square feet, the latter a cosy attachment to the sitting room of a New England farm house, from which the lady of the house sells annually $35 to $50 worth of plants and flowers.

There are in the United States 965 state and local floral societies and clubs, besides the Society of American Florists, and to these and the more than 358 horticultural societies, combined with the educational influences of the agricultural and horticultural press, is largely due the rap-

idly growing taste for flowers and their culture, so plainly indicated by the figures of this report.

The statistics here given have been obtained direct from the florists themselves in answer to questions sent them on special schedules, by personal visitation, and by the combined efforts of some of the florists' clubs. The California State Floral society went so far as to aid in the good work by appointing a special committee and making a careful canvass of the whole state, and the census office investigations fully corroborate the thoroughness of their work.

The following table shows, by states, the number of florists' establishments, number owned by women, largest and smallest greenhouse in each state, total square feet of glass, area of land cultivated, value of tools and implements, and total value of establishments. New Jersey, situated as it is between the New York and Philadelphia city markets, makes the largest showing of any state in the Union in proportion to its size.

PRODUCTIONS AND SALES.

In this investigation it was found unadvisable to attempt to ascertain the number of plants propagated and sold of each variety, and therefore the inquiries were grouped under three heads: roses, hardy plants and shrubs, and all other plants, and under these heads most of the florists were able to furnish a complete statement of their business. Roses, both the plants and bloom, appear to be in the greatest demand. One firm making a specialty of rose propagation reports having sold one million plants in 1889. Their plants were mostly small ones, grown in $2\frac{1}{2}$-inch pots, sent out by mail all over the country, and delivered promptly and in good condition.

Other florists make a specialty of the rose for the production of cut flowers. Others, again, grow only carnations or violets, and wholesale their productions to the retail florists in cities. Still others grow a variety of both plants and cut flowers, and wholesale most of the entire product; and, in fact, this is the business of nearly all the large establishments, while the medium ones, of from 1,504 to 5,000 square feet of glass area, do mostly local business, largely at retail, of both plants and flowers. Many of these florists also do a considerable business in the spring season in the arrangement and planting of both public and private grounds, and especially is this the case with florists located near the summer resorts.

Of the plants sold the demand in the northern and eastern states is greatest for geraniums, coleus, roses, pansies, verbenas, heliotrope, carnations, chrysanthemums, palms, ferns, and fuchsias, nearly in the order named. In the south the demand is for roses, chrysanthemums, geraniums, coleus, palms, and ferns, while California shows the demand to be largest for roses, carnations, chrysanthemums, geraniums, palms, and pansies. There is also a very general and growing demand for aquatic plants, and specialists are giving marked attention to this branch of the business. Regarding cut-flower sales, reports show that, while there is a slight variation in the demands of the different markets, the greatest demand everywhere is for roses, followed closely by carnations. These two furnish about 65 per cent. in value of all cut flowers sold. Violets, chrysanthemums, lilies, hyacinths, smilax, bourvardia, heliotrope, pansies, and tulips, in the order named, supply 25 per cent. more, while the other ten per cent. is made of orchids, tuberoses, mignonette, primroses, camellias, daffodils,

and many others cultivated in a small way to supply a special or local demand. In the final report it will be the endeavor to give a detailed statement regarding each class of production, insect enemies, remedies, etc. As to the profits in the business from the different classes of plants, 80 per cent. of the reports mention roses as most profitable, carnations second, and violets third, while 20 per cent. rank carnations first, roses second, and violets third.

HORTICULTURE.—NURSERIES.

Bulletin No. 109.

Herewith is presented a preliminary report, prepared by Mr. J. H. Hale, special agent under the direction of Mr. Mortimer Whitehead, special agent in charge of horticulture, upon the nursery industry of the United States, which has for the first time been made a subject of census investigation. The material from which these statistics are compiled was obtained direct from the nurserymen, upon schedules specially prepared for that purpose, and by personal visits of special agents to nursery establishments in all parts of the country. These figures are subject to revision before publication in the final report.

From the tabulations in this bulletin it appears that there are in the United States 4,510 nurseries, valued at $41,978,835.80 and occupying 172,806 acres of land, with an invested capital of $52,425,669.51, and giving employment to 45,657 men, 2,279 women, and 14,200 animals, using in the propagation and cultivation of trees and plants $990,606.04 worth of implements. Of the acreage in nurseries 95,025.42 were found to be used in growing trees, plants, shrubs, and vines of all ages; and the figures, based upon the best estimate of the nurserymen, make the grand total of plants and trees 3,386,855,778, of which 518,016,612 are fruit trees, 685,603,396 grapevines and small fruits, and the balance nut, deciduous, and evergreen trees, hardy shrubs, and roses. The largest acreage is devoted to the production of apple trees, viz: 20,232.75 acres, numbering 240,570,666 young trees, giving an average of 11,890 per acre, while the plum, pear, and peach have, respectively, 7,826.5, 6,854.25, and 3,357 acres, producing 88,494,367, 77,223,402, and 49,887,894 young trees, or an average of 11,307, 11,266, and 14,861 trees to the acre.

The table showing the date of establishment and the columns in the various tables of production indicating the per cent. of increase clearly prove the steady growth of this industry, while the great increase in the planting of large orchards and the constantly developing taste and demand for fruit and ornamental trees, vines, shrubs, and plants for home adornment assures the continued growth and prosperity of this industry.

Robert P. Porter,
Superintendent of Census.

NURSERIES.

BY J. H. HALE.

Horticulture, that higher art of agriculture, has been making wondrous strides in this country during the last quarter of a century, and as the foundation of nearly all this great work lies in the little nursery row of seedlings, dormant buds, root grafts, or cuttings, it seemed fitting that the eleventh census of the United States should, for the first time, take account of stock in this particular direction; hence this report upon nurseries, which, though somewhat crude in its way, at least will show, in connection with other special horticultural investigation, the tendency of the people in the way of a more refined agriculture, in the production, not only for home adornment and consumption, but for commercial purposes also, of fruits, flowers, trees, and shrubbery, all so refining and purifying in their influences as to ennoble all who come in daily contact with them.

While most of the first trees and plants were of necessity brought from the mother country by the early settlers, their production from seeds and by budding, grafting, and layering was begun here early in the seventeenth century, as shown by many of the early colonial records, points of especial interest upon this subject having been gathered by the Massachusetts Horticultural society and published in the introduction of the history of the society as "a sketch of the history of horticulture in the United States up to the year 1829," the date of organization of that society. A memorandum in the records of the Massachusetts Company, March 16, 1629, says:

To provide to send for New England Vyne Planters, Stones of all sorts of fruites, as peaches, pears, plums, filberts, cherries, pear, aple, quince, kernells, pomegranats; also wheat, rye, barley, oates, woad, saffron, liquorice seed and madder rootes, potatoes, hop rootes, currant plants.

George Fenwick of Saybrook, Connecticut, wrote on May 6, 1641, to Governor Winthrop of Massachusetts:

I haue receaued the trees yow sent me, for which I hartily thanke yow. If I had anything heare that could pleasure yow, yow should frely command it. I am prettie well storred with cherrie & peach trees, & did hope I had had a good nurserie of aples, of the aples yow sent me last yeare, but the wormes haue in a manner distroyed them all as they came up. I pray informe me if yow know any way to preuent like mischiefe for the future.

March 5, 1665, John Mason of Saybrook, Connecticut, wrote to Mrs. Elizabeth Winthrop:

Haue sent ten apple trees by Goodman Stolyon to yourselfe. I suppose they will most of them be planted in the north end of your orchard. I would haue sent more if I had thought there were a place to receiue them. I haue alsoe sent Thomas Bayley thirty grafted trees as hee desired mee. They are in Goodman Stolyon's boate. I would entreat you to acquait him with it. Hee told mee hee would put it to Mr. Winthrop's account. They came to thirty shillings.

Prince's nursery and botanic garden was established at Flushing, Long Isand, about the middle of the last century, by William Prince, and for more than one hundred years was continued by his descendants.

John Watson established a nursery near Charleston, South Carolina, about 1760, and a botanic garden was established there in 1786.

In 1768 the Society for Promotion of Arts at New York awarded a premium of £10 to Thomas Young, of Oyster Bay, for the largest number of apple trees, the number being 27,123.

In 1796, George Heusler, on the farm of Elias H. Derby, in the town of Danvers, Massachuseets, was offering trees for sale.

In 1796 two brothers by the name of Vaughn established a nursery at Hallowell, Maine, and by importing and testing all the leading varieties of Europe did much to advance the horticulture of Maine. Ephriam Goodale also started a nursery at Orrington, Maine, about 1800.

This being the first time that the nurseries have ever been made the subject of special census inquiry, there was found but little recorded data to guide in the work; in fact, nothing to build upon except the notes just given and the shaky foundation of a so-called "nursery directory," representing many dead firms, as well as others who were only dealers and not growers of nursery stock. However, these were finally all weeded out, and with the friendly assistance of the active nurserymen in each state, coupled with the official work of the census enumerators, a live list was secured, representing every producer of nursery stock in the United States. These were all furnished with special blanks for full detailed report of their productions, and while all have not reported, a very large majority have, thus supplementing the figures given the census enumerators, which form the basis of the tables of acreage and value. Many of the nurserymen reported, keeping no record as to cost of production, labor, etc., had to estimate this expense; but, however, as in nearly every instance these estimates are very nearly the same as the figures furnished by others in the same states who did keep a record, they are doubtless approximately correct, as are the other figures here given, which show that there are in the United States 4,510 nurseries, valued at $41,978,835.80 and occupying 172,806 acres of land. In this business there is a total capital of $52,425,669.51 invested, which employs 45,637 men, 2,279 women, and 14,200 animals, propagating and cultivating trees and plants, with the aid of $990,606.04 worth of implements.

There were found growing in the United States 95,025.42 acres of trees, plants, shrubs, and vines of all ages, and figures based upon the best estimates of the nurserymen make the grand total of plants and trees 3,386,855,778 (not including miscellaneous fruit trees and plants grown on 1,477 acres), of which 518,016,612 are fruit trees, 685,603,396 grapevines and small fruits, and the balance evergreen and deciduous trees, hardy shrubs, and roses.

The following table shows the number grown of each class of trees and plants, together with the number of acres and the average number grown per acre:

Trees or plants.	Number of acres.	Average number grown per acre.	Total number grown.	Trees or plants.	Number of acres.	Average number grown per acre.	Total number grown.
Apple	20,232¾	11,890	240,570,666	Quince	518	11,675	6,047,680
Apricot	269	11,689	3,144,466	Nut	1,370½	10,072	13,803,006
Cherry	3,690	10,362	38,236,254	Deciduous	12,342	105,121	1,297,408,257
Fig	63¼	11,734	742,200	Evergreen	8,644½	95,094	822,038,324
Lemon	79	6,998	552,841	Hardy shrubs	2,881	15,989	46,072,530
Lime	6	10,688	64,125	Rose	346½	11,295	3,913,653
Nectarine	50	13,054	652,679	Grapevines	5,673	28,052	159,139,248
Olive	26	12,616	328,016	Strawberry	4,433	61,157	271,108,253
Orange	607½	7,191	4,368,322	Raspberry	5,756⅓	15,025	86,487,491
Peach	3,357	14,861	49,887,894	Blackberry	4,889⅓	21,539	105,310,810
Pear	6,854¼	11,266	77,223,402	Currant	2,021	24,432	49,376,805
Plum	7,826½	11,307	88,494,367	Gooseberry	1,009½	14,047	14,180,789
Pomelo	14	5,764	80,700	Miscellaneous fruit trees and plants	1,477		
Prune	588	12,964	7,623,000				

The total value of these products in the nursery is upward of $100,000,000 if sold at market rates; but the fluctuation in demand for the various varieties is such that there is often a considerable surplus of stock on hand of some varieties of too great age or inferior grade, which has to be sold at whatever price is offered or else thrown on the brush heap to be burned, so that nearly 20 per cent. of all stock produced annually remains unsold.

As nearly all trees and many plants are seldom sold till two or three years old, the stock in nurseries, as above enumerated, really represents a two years' supply.

The following tables present interesting statistics concerning the nurseries of the United States at the taking of the eleventh census:

Nurseries and Capital Invested.

States and territories.	Number of nurseries.	Acres of land.	Value per acre. a	Total value of nurseries. b	Value of implements.	Total capital invested.
The United States	4,510	172,806		$41,978,835 80	$990,606 04	$52,425,669 51
North Atlantic division:						
Maine	41	226	$126 67	$180,912 51	$10,303 75	$208,177 50
New Hampshire	5	23	275 00	8,166 65	400 00	14,500 00
Vermont	17	75	341 67	35,000 00	1,661 00	46,500 00
Massachusetts	120	1,891	404 71	1,393,666 80	37,249 20	1,773,500 00
Rhode Island	9	45	125 00	36,000 00	1,200 00	58,500 00
Connecticut	20	328	179 78	146,509 00	7,030 00	194,071 57
New York	530	24,840	272 50	10,609,866 30	172,048 60	12,202,844 50
New Jersey	145	5,465	266 13	1,712,464 75	53,195 35	1,970,593 90
Pennsylvania	311	6,598	357 29	3,134,780 63	106,865 82	4,210,805 50
Total	1,198	39,491		$17,257,366 64	$389,953 72	$20,679,492 97

a The value of nursery land in many instances is regulated more by its proximity to cities and towns than by its productive value for nursery purposes.

b It is evident from the figures furnished by the nurserymen as to the total value of nurseries that in most cases growing stock is not estimated at much more than one fourth its market value when sold. No doubt this is just and fair, as perishable products of this sort are of value only as they can be sold, and their sale depends largely upon advertising and the solicitation of catalogues and traveling salesmen, and if not disposed of when they arrive at proper size and age they soon become valueless.

Nurseries and Capital Invested.—Continued.

States and territories.	Number of nurseries.	Acres of land.	Value per acre.	Total value of nurseries.	Value of implements	Total capital invested.
South Atlantic division:						
Delaware	35	725	$132 50	$111,805 40	$4,480 00	$155,361 15
Maryland	50	1,443	70 00	305,000 00	10,111 00	519,400 00
District of Columbia	1	120	500 00	120,000 00	600 00	125,000 00
Virginia	54	1,890	114 55	832,336 02	8,017 00	922,172 58
West Virginia	22	633	120 83	115,500 00	1,265 00	126,086 40
North Carolina	32	960	26 39	111,200 00	11,840 00	231,840 00
South Carolina	3	70	25 00	2,700 00	75 00	4,000 00
Georgia	16	812	105 67	180,070 00	1,600 00	277,960 00
Florida	137	1,374	228 34	419,766 49	10,751 86	456,224 93
Total	350	8,027		$2,198,377 91	$48,739 86	$2,818,045 06
North Central division:						
Ohio	393	16,790	$140 44	$3,159,358 44	$114,610 59	$4,178,518 19
Indiana	223	5,464	90 75	791,858 47	26,209 19	1,056,611 91
Illinois	434	17,812	150 09	3,595,850 58	54,362 84	4,778,083 94
Michigan	155	3,015	116 40	502,296 65	25,962 50	869,491 10
Wisconsin	117	1,651	133 50	456,797 25	32,931 99	492,277 50
Minnesota	69	1,726	125 00	504,045 00	9,487 50	652,433 64
Iowa	183	12,049	93 40	1,276,979 49	29,648 48	1,591,790 73
Missouri	229	15,190	232 59	2,604,746 15	47,432 77	2,932,473 24
North Dakota	13	26	100 00	26,000 00	975 00	45,500 00
South Dakota	27	586	54 78	88,425 00	4,146 39	126,749 88
Nebraska	177	15,641	67 44	1,364,996 61	43,807 50	1,479,953 64
Kansas	339	11,492	83 39	1,261,798 34	45,605 67	1,425,792 81
Total	2,359	101,442		$15,633,141 98	$435,180 42	$19,629,676 58
South Central division:						
Kentucky	49	621	$102 88	$240,610 58	$8,483 37	$504,393 75
Tennessee	54	1,642	86 36	604,200 00	15,390 00	1,015,971 66
Alabama	15	975	26 37	272,152 50	6,067 50	455,040 00
Mississippi	15	505	47 90	56,062 50	2,025 00	79,284 45
Louisiana	24	280	205 00	159,000 00	1,200 00	170,400 00
Texas	97	4,665	108 75	738,882 95	14,020 38	1,211,930 61
Arkansas	68	767	38 90	80,410 00	7,572 48	119,800 36
Total	322	9,455		$2,151,318 53	$54,758 73	$3,556,820 83
Western divsion:						
Colorado	23	637	$144 00	$106,250 00	$7,084 00	$162,916 59
New Mexico	1	70	200 00	15,000 00	140 00	15,200 00
Arizona	3	82	50 00	6,175 00	100 00	8,500 00
Utah	17	199	168 75	61,880 00	708 39	83,810 00
Idaho	8	248	236 67	124,000 00	1,500 00	172,000 00
Washington	27	435	138 89	100,980 00	3,972 78	190,620 00
Oregon	36	1,576	93 79	165,494 16	4,287 24	236,658 00
California	166	11,144	290 08	4,158,851 58	44,180 90	4,871,929 48
Total	281	14,391		$4,738,630 74	$61,973 31	$5,741,634 07

Of the 4,510 nurseries in the United States fully two thirds are small concerns, from 2 to 25 acres in extent, and produce a full variety of all trees and plants for local demands, much of the stock sold being taken direct from the nursery by the planters and local agents, so that there is but little call for advertising, catalogues, or traveling salesmen. Another class of nurserymen, propagating largely a general line of nursery stock or making specialties of a few lines only, such as grapes or small fruits, cater to a direct retail trade with customers all over the country, and advertise extensively in the newspapers and mail hundreds of thousands of

catalogues, and in return receive their orders by mail, when stock is shipped direct to planters by mail, freight, or express. There are other and still larger nurseries that produce stock by the hundreds of acres and cater to the wholesale trade by issuing trade catalogues only to other nurserymen, extensive planters, and to nursery agents and dealers, who are their best customers. Some of these nurseries are upward of 1,000 acres in extent, and their products are shipped in car-load lots, and in the busy season almost by train loads. Still another class of nurserymen produce a general assortment of stock and sell direct to planters through the solicitation of traveling salesmen, who canvass from house to house and from farm to farm and succeed in selling millions of trees and plants, mostly to persons who would not take the trouble to visit a nursery or send for a catalogue and order direct from the nursery. Thousands of trees are now growing in what would otherwise have been waste places had it not been for these missionaries of horticulture.

The table showing the date of establishment and the columns in the various tables of production [omitted here] indicating the per cent of increase clearly prove the steady growth of the nursery industry. While a few eastern states show a slight falling off in the production of some kinds of nursery stock, Vermont is the only state to show a falling off in all lines of production. Maine also shows a considerable decrease in several lines. Florida shows a decrease in orange tree production, brought about by the discouragement of planters by the hard freeze of 1886; but with these few exceptions the increased production is from 15 to 300 per cent, being greatest in the states of the North Central division and on the Pacific coast. With this greatly increased production has come about a considerable decrease in the selling price, so that while the nurserymen appear to be prosperous financially, greater knowledge in the art of production and better methods of culture enable them to produce better stock at less cost, conditions all favorable to the planter and not in the least discouraging to the nurseryman who understands his business.

At first thought it would seem that the annual production of all these millions of trees and plants would soon overstock the country, but it is a sad fact to contemplate that damage in transit and climatic conditions, coupled with the carelessness of many planters, result in killing nearly one half the plants and trees sent out each year, and further neglect results in the loss of one half of those remaining before the end of the third year; and it has been estimated by some horticulturists that of all the trees set out not more than 1 in 20 ever comes to full fruiting. This is not so much on account of soil and climatic conditions as from ignorance and carelessness of the average planters, for skilled orchardists have little trouble in bringing 90 per cent of all trees planted into full fruitage. This loss of trees, coupled with the steady growth of the country and the increased taste in horticultural matters, must of necessity cause the demand for nursery products to be even greater in the future than in the past. Twenty years ago a fruit orchard 50 acres in extent was considered a wonder; now in nearly every state apple, pear, and peach orchards of 100, 200, and 300 acres are being planted, while in Georgia and California there are many peach orchards of 1,000 or more acres each. The greatest and most steady demand, however, will ever continue to be for plants and trees for the home ground and the fruit garden. The latter, a luxury a few years ago, is fast becoming a recognized necessity, and as greater attention is being given it each year it can not fail to help the nursery trade, and so it is expected to grow and prosper even more in the future than in the past.

HORTICULTURE.—SEED FARMS.

Bulletin No. 111.

The production of seeds as an industry has been for the first time made a subject of census investigation. This report is prepared by Mr. J. H. Hale, special agent, under the direction of Mr. Mortimer Whitehead, special agent in charge of horticulture. The material from which these statistics are compiled was obtained directly from the seed growers upon schedules prepared for that purpose and by personal visits of special agents to seed farms and dealers in all parts of the country. The figures are subject to revision before publication in the final report.

This investigation included only such farms as were devoted to seed growing as a business, and did not consider the large amount of field and garden seeds grown as side crops on thousands of farms, which would greatly swell the aggregate yield of seeds, but would not fairly estimate seed growing as a special industry. It will be noted that seed growing has been carried on as a business in this country for more than a century, but that only within the past 30 years has it assumed large proportions. More than one half the total number of establishments reported were started between 1870 and 1890. This report shows that there were in the United States in the census year 596 farms, with a total of 169,851 acres, devoted exclusively to seed growing, of which 96,567¼ acres were reported as producing seeds. Of these, 12,905 acres were devoted to beans, 1,268 to cabbage, 919 to beets, 10,219 to cucumbers, 71 to celery, 15,004 to sweet corn, 16,322 to field corn, 4,663 to squashes, 7,971 to peas, 5,149 to muskmelons, 662 to radishes, and 4,356 to tomatoes. The 596 seed farms reported represent a total value of farms, implements, and buildings of $18,325,935.86, and employed in the census year 13,500 men and 1,541 women; 258 of these farms are in the North Atlantic division, with an average of 185 acres per farm. In the North Central division there are 157 seed farms, with an average of 555 acres per farm. The seed farms in Iowa and Nebraska average 695 acres, several being nearly 3,000 acres in extent.

Robert P. Porter,
Superintendent of Census.

SEED FARMS.

BY J. H. HALE.

Seeds of all staple garden and farm grains, fruits, and vegetables have been in steady demand since the first settlement of the country. In early times families preserved seed supplies from their own productions from year to year, in most cases from whatever might be left on the farm, while in other cases a careful selection was made and purer and better seeds obtained, which not only furnished the home supply, but were eagerly sought by friends and neighbors. For many years little was known of seeds as a commercial product, and even at the present time in many rural

communities some of the more common farm seeds are freely exchanged among the farmers.

The first regular seed farm of those now in the country, as far as we have any record, was established in connection with the nursery business in Philadelphia in 1784.

The general growth of the country, the great increase of population in cities and villages and consequent establishment of market gardens, the demand for choice seeds and often the inability to procure them, induced market gardeners to grow and save seeds, at first for their own uses only, later to supply an ever increasing demand, until some finally drifted into seed production as a regular business.

This branch of horticulture has never before been made the subject of census inquiry. Therefore, with no recorded data to guide in the work, it has been somewhat difficult to procure even the few facts and figures of the tables herewith submitted.

After careful inquiry by circular letter (often many times repeated) to each and every seed dealer in the United States, a record was made showing a total of 596 farms in the United States devoted exclusively to seed production. These farms occupy 169,851 acres of land, of which 96,567¼ acres were reported as devoted to seed production during the census year, divided as follows: 1,437 acres of asparagus; 12,905 of beans; 919 of beets; 1,268 of cabbage; 569 of carrots; 11 of cauliflower; one half of celeriac; 71 of celery; 13 of collards; 1½ of corn salad; 15,004 of sweet corn; 16,322 of field corn; 1½ of cress; 10,219 of cucumbers; 39¾ of dandelion; 252 of eggplants; 16 of endive; 105 of kale; 19 of kohl-rabi; 13½ of leek; 486½ of lettuce; 5,149 of muskmelons; 3,978 of watermelons; 2 of nasturtium; 13 of okra; 3,560 of onions; 352 of onion sets; 75 of parsley; 374 of parsnips; 7,971 of peas; 365 of pepper; 4,102 of potatoes; 105 of pumpkins; 662 of radishes; 25 of rhubarb; 26 of salsify; 150 of spinach; 4,356 of tomatoes; 885 of turnips; 4,663 of squashes, and 81 of flower seeds.

Aside from these special seed farms which have been under investigation, there are a number of extensive dealers in seeds having test gardens and farms, where side by side all new and old varieties are grown for the purpose of comparison. On these farms are also tested all seeds handled by these dealers. whose custom it is to secure their supplies by importation and by contracting with farmers in various favored sections of this country to grow any particular variety of seed best adapted to that farmer's land or locality. Some of these are among the regular seed farms here enumerated; others grow one or more varieties of seed each year only as a branch of their other farming operations, and as no special note of their productions was made by the regular census enumerator, and the dealers in some instances have failed or refused to furnish the names of these farmers, it has been impossible to get at them by special schedule, which has been the medium for collecting this information. Therefore, while this report shows the extent and production of the seed farms proper, the total of garden seeds produced in the United States is considerably in excess of the amount here given. One dealer reports supplying farmers annually 1,000 bushels of peas and 2,000 bushels of beans for planting, and then buying back all the seeds that can be grown from this stock, which amounts to about 10,000 bushels each of peas and beans; and

as many other dealers have contracts in like proportion on various other seeds, it will be seen that the garden-seed business alone is assuming great importance in the agriculture of the country. Again, while the greater amount of seed grains, cotton, tobacco, etc., used upon farms is of home and neighborhood production and is freely exchanged for labor or for other products, there are in nearly every county one or more successful farmers who by a careful selection of seed stock and by better methods secure greater returns than their neighbors and are able to dispose of part of their productions for seed purposes at advanced rates. These men can not be classed as seed farmers, and would hardly be able to estimate what proportion of their crops was sold for seed purposes annually; but it is safe to assume that such farmers produce one third of all the small grains, corn, potatoes, tobacco, and cotton seed planted. In addition to these, there are annually sold for seed purposes upward of 1,000,000 bushels of selected grains, both of the standard and newer varieties, very little of which is produced upon regular seed farms. The same is true of grass seeds, which are produced in enormous quantities in New York, Pennsylvania, Ohio, Indiana, Illinois, Kentucky, Michigan, Minnesota, Missouri, Kansas, and Nebraska, largely supplying the demands of the country as well as furnishing a considerable surplus for export. The quantity and value of this production will be shown in the final census reports.

Of the 596 seed farms in the United States, 258, or nearly one half, are in the North Atlantic division, the original center of seed production. The farms have an acreage of 47,813, or an average of 185 acres per farm, while in the North Central division there are 157 farms, with an acreage of 87,096, or an average of 555 acres per farm. The seed farms of Massachusetts and Connecticut average 142 acres per farm, while those of Iowa and Nebraska are 695 acres in extent, and are producing seeds on a scale of equal magnitude to the other products of that section of the country. Several of these seed-producing farms embrace nearly 3,000 acres each.

The table showing date of establishment as seed farms indicates in a general way the growth and prosperity of the business. So far as reported, there were but 2 seed farms in the country previous to 1800 (one of these was established in Philadelphia in 1784, and the other at Enfield, New Hampshire, in 1795), only 3 in 1820, 6 in 1830, 19 in 1840, 34 in 1850, 53 in 1860, 100 in 1870, 207 in 1880, and 200 more were established between 1880 and 1890, leaving 189 unaccounted for as to date of establishment. But as the proprietors of the older seed farms take great pride in this matter, it is safe to assume that 90 per cent. of the unreported farms have come into existence within the past 20 years.

The following table shows, by states, the number of seed farms in the United States, number of acres of land in farms, average value per acre, value of tools and implements used, and total value of farms, tools, implements, buildings, etc.:

Number and value of seed farms in the United States.

Geographical divisions.	Number of seed farms.	Acres of land in farms.	Value of land per acre.	Value of implements.	Total value of farms, implements and buildings.
The United States	596	[a] 169,851		$221,736 90	$18,325,935 86
North Atlantic	258	47,813		$121,212 61	$7,856,492 86
Maine	2	110	$20 00	$80 00	$6,954 00
New Hampshire	5	225	50 00	625 00	24,543 75
Vermont	6	618	87 50	1,050 00	59,140 25
Massachusetts	25	3,000	216 67	13,750 00	809,448 00
Rhode Island	5	605	200 00	3,416 70	141,137 53
Conneticut	85	12,665	96 00	44,306 25	1,501,653 56
New York	78	18,252	111 19	43,014 66	2,176,076 72
New Jersey	34	6,272	200 00	4,800 00	2,333,066 68
Pennsylvania	18	6,066	118 75	10,170 00	804,832 37
South Atlantic	89	4,958		$23,355 00	$406,698 64
Maryland	2	212	$125 50	$800 00	$32,865 00
District of Columbia	1	120	200 00	100 00	26,000 00
Virginia	3	249	50 00	1,500 00	15,000 00
West Virginia	1	50	40 00	50 00	4,000 00
North Carolina	1	180	30 00	100 00	7,400 00
South Carolina	4	760	100 00	1,300 00	82,100 00
Georgia	31	2,627	40 00	9,921 00	177,000 00
Florida	46	760	45 00	9,584 00	62,333 64
North Central	157	87,096		$54,425 54	$7,095,665 42
Ohio	32	19,048	$95 00	$23,116 80	$2,110,000 00
Indiana	12	7,092	80 00	3,800 00	600,918 00
Illinois	21	13,357	125 00	3,220 14	1,717,432 25
Michigan	20	11,620	40 71	4,500 00	527,350 00
Wisconsin	21	2,919	50 00	3,500 00	180,878 50
Minnesota	6	1,140	32 50	1,200 00	47,737 00
Iowa	18	11,152	53 75	3,578 00	633,923 67
Missouri	2	790	80 00	400 00	68,000 00
North Dakota	1	60	30 00	75 00	3,000 00
Nebraska	18	13,870	63 20	9,675 00	907,746 00
Kansas	6	6,048	50 00	1,360 00	298,680 00
South Central [b]	57	23,130		$4,950 00	$1,015,200 00
Kentucky	2	250	$100 00	$300 00	$28,300 00
Tennessee	35	21,560	40 00	3,500 00	937,500 00
Mississippi	2	80	35 00	100 00	4,900 00
Texas	17	1,200	25 00	1,000 00	42,500 00
Arkansas	1	40	30 00	50 00	2,000 00
Western	35	6,854		$17,793 75	$1,951,878 94
Colorado	1				
Washington	2	150	$100 00	$100 00	$18,000 00
Oregon	17	289	170 00	1,700 00	80,588 00
California	15	6,415	287 50	15,993 75	1,853,290 94

[a] This amount represents the total acreage in farms, only a portion of which is cultivated for seeds any one year. The balance is devoted to grass, pasturage, or a rotation of farm crops in preparation for seed production. Some seed farmers, however lease a considerable area of land or contract to have seed grown for them by neighboring farmers, and so show a greater acreage of seed production than the total acreage of their farms. This is especially true in the North Atlantic division.

[b] No record of any seed farm in Alabama, except a floating newspaper paragraph, which credits one man with the production of 32,000 pounds of garden seeds, which were sold to northern dealers.

From general information obtained from the seed farmers and a study of the figures in this bulletin it appears that this branch of agriculture has kept fully apace with the general march of national progress.

Prior to 1850 all the seed farms of the country were in the few northeastern states of the Union, Connecticut and New York for more than half a century producing more seeds than all other states combined; and while each has at present more seed farms than any other state, the general westward tendency of all that pertains to agriculture has stimulated seed growing on a very extensive scale in the central west and on the Pacific coast. There has of late been a feeling of depression among the growers generally, who, previous to 1883, made exceptionally fine profits out of the business, and were thus stimulated to establish more seed farms than could profitably find market for their products during the past few years. The general feeling now is that prices must be advanced or some method of production be discovered whereby a greater yield may be secured at less cost of labor.

Final census reports will strive to show in detail some of the methods adopted by the more successful seed farmers in the different sections.

HORTICULTURE.—TROPIC AND SEMITROPIC FRUITS AND NUTS.

Bulletin No. 97.

For the first time the census office has made a special investigation for the purpose of ascertaining the extent and value of the production of oranges, lemons, figs, almonds, cocoanuts, and other tropic and semitropic fruits and nuts as industries of the United States, and herewith is presented a preliminary report prepared by Mr. J. H. Hale, special agent, under the direction of Mr. Mortimer Whitehead, special agent in charge of horticulture.

The material from which these statistics are compiled was obtained direct from the growers upon schedules specially prepared for that purpose and by personal visits of special agents to sections of the country where these products are grown.

From the tabulations in this bulletin and in the table herewith appended it appears that in addition to the tropic and semitropic fruits and nuts grown for home and family use there were in the census year 13,515 acres of almond, 677.50 of banana, 169.88 of citron, 9,864 of cocoanut, 4,477 of fig, 550 of guava, 1,362.25 of kaki, 7,256 of lemon, 495.58 of lime, 12,180 of madeira nut, 7,097 of olive, 184,003 of orange, 2,189.50 of pineapple, 171.89 of pomelo, and 27,419.50 of pecan trees, representing 658,566 bearing and 800,010 nonbearing almond trees, 577,782 bearing banana plants, 4,237 bearing and 14,110 nonbearing citron trees, 123,327 bearing and 1,199,549 nonbearing cocoanut trees, 138,186 bearing and 285,201 nonbearing fig trees, 32,943 bearing and 120,529 nonbearing guava trees, 58,390 bearing and 124,522 nonbearing kaki trees, 167,663 bearing and 498,784 nonbearing lemon trees, 19,096 bearing and 44,255 nonbearing lime trees, 188,409 bearing and 411,248

nonbearing madeira nut trees, 278,380 bearing and 331,022 nonbearing olive trees, 3,885,890 bearing and 9,705,246 nonbearing orange trees, 21,750,000 pineapple plants, 3,279 bearing and 12,867 nonbearing pomelo trees, and 214,988 bearing and 657,980 nonbearing pecan trees.

Excluding pineapples and bananas, which are all counted as bearing plants, as they commence fruiting within a year of planting, it will be noted that the average number of all nonbearing trees is about double that of the bearing trees, the product of which in the census year was, so far as reported, valued at $14,116,226.59, divided as follows: Almond $1,525,-109.80, banana $280,653.75, cocoanut $251,217.41, fig $307,271.76, lemon $988,099.92, lime, $62,496.90, madeira nut $1,256,958, olive, $386,368.32, orange $6,602,099.06, pineapple $812,159.17, pomelo $27,216, and pecan $1,616,576.50. On the basis of present prices, with all the nonbearing trees in fruitage, the next census ought to show a value of product of more than $50,000,000. As a forecast of the future growth of these branches of horticulture, in addition to the acreage already planted, the number of acres of land in the United States susceptible of development in plant in any one or all of the fruits and nuts named has been ascertained, and the aggregate figures are also given.

Kinds of fruit and nut.	Number of acres of bearing and nonbearing trees and plants.	Number of bearing trees and plants.	Number of nonbearing trees and plants.	Value of product for year 1889.	Estimated number of acres suitable for planting tropical fruits and nuts.
Total	271,428.10	28,101,036	14,205,323	$14,116,226 59	24,710,879
Almond	13,515.00	658,566	800,010	$1,525,109 80	2,417,349
Banana	677.50	577,782	----------	a 280,653 75	446,481
Citron	169.88	4,237	14,110	b	1,153,222
Cocoanut	9,864.00	123,227	1,199,549	251,217 41	192,067
Fig	4,477.00	138,186	285,201	a 307,271 76	3,013,899
Guava	550.00	32,913	120,529	b	2,075,300
Kaki	1,362.25	58,390	124,522	b	2,831,369
Lemon	7,256.00	167,663	498,784	988,099 92	1,276,648
Lime	495.58	19,096	44,255	a 62,496 90	1,203,142
Madeira nut	12,180.00	188,409	411,248	1,256,958 00	1,785,121
Olive	7,097.00	278,380	331,022	386,368 32	2,893,116
Orange	184,003.00	3,885,890	9,705,246	a 6,602,099 06	2,260,855
Pecan	27,419.50	214,988	657,980	1,616,576 50	1,546,460
Pineapple	2,189.50	21,750,000	----------	a 812,159 17	866,084
Pomelo	171.89	3,279	12,867	a 27,216 00	1,349,766

a Value partially given; not fully reported. b Value of product not reported.

ROBERT P. PORTER,
Superintendent of Census.

TROPIC AND SEMITROPIC FRUITS AND NUTS.

BY J. H. HALE.

In undertaking an investigation of the semitropic fruit and nut industries of the United States a most difficult task was imposed. No single branch of the work had ever before been investigated. However, starting with a list of names, kindly furnished by the Division of Pomology of the United States Department of Agriculture, supplemented later by those of

all semitropic fruit and nut growers furnished by the census enumerators, every producer in the United States has been reached through special schedules of inquiry; and while many have failed to respond to the requests, even though ofttimes repeated, a great number have furnished the information sought to be brought out by the 66 questions asked on these schedules regarding almonds, bananas, citrons, cocoanuts, dates, figs, guavas, kaki, lemons, limes, madeira nuts, olives, oranges, pineapples, pomelos, pomegranates, and pecans. Supplementing this information with that obtained by personal visits to leading centers of production and special information received from well-informed cultivators of the various products under investigation, the information has been obtained which furnishes the basis for this bulletin and a more complete report for the final publication.

The total acreage was gathered by the regular census enumerators under the head of "Other orchard fruits," while the special classification has been made on the basis of figures furnished upon the special schedules and from personal knowledge of the special agent.

The production of the fruits and nuts under consideration is confined largely to the states of California and Florida, but figs, oranges, kaki, and pecans were found growing to a considerable extent in all states bordering on the gulf of Mexico. While Louisiana and Arizona have each a considerable acreage in oranges, the trees of Arizona are nearly all young and of recent planting.

In all these investigations it has been found that the great march of progress moving in other lines of industry has not left these behind; in fact, so rapid is now the increase in citrus fruit planting, and so favorable are the conditions, especially in California, that there are many well informed in the business who believe that within another decade the United States will not only produce its full supply of citrus fruits, but also export them quite largely.

The acreage of oranges, as a matter of course, exceeds that of all the other products, yet the possibilities of pineapple culture on the southeast coast of Florida and for 100 miles north of Key West, on the gulf coast, are such as to give promise of a very great and profitable extension of the culture of this delicious fruit.

Pecan culture in northwest Florida and all the gulf states has apparently just begun to develop some of its wonderful possibilities as a reliable and profitable crop, while there is every reason to believe that within a few years the figs, olives, madeira nuts, and lemons of California will rival in value her wondrous crops of oranges; and yet a comparison of the tables of bearing and nonbearing trees will show three times as many nonbearing as bearing orange trees in the census year, and as planting has been going on more rapidly than ever since the census was taken, the number of orange trees now growing in California must be nearly double that of 18 months ago, all of which means an output of at least 10,000,000 boxes of oranges from California before the end of the present century.

The Florida figures, which show a still greater proportion of nonbearing to bearing trees than do those of California, are somewhat misleading, if from them is made the deduction that there is a greater increase of planting in Florida than in California, for, as a matter of fact, it is just the reverse. For a few years previous to the hard freeze of 1886, which did such great injury to the orange groves of Florida, there was an enormous planting of young orange trees, while since that time there has been very

little. Therefore most of the nonbearing trees reported have been planted 5 or more years. while the reverse is true of California. Most of the orange trees in that state reported as nonbearing have been planted since 1886, and very many of them during the census year.

Arizona makes quite a showing of young orange trees, the mere beginning of a new industry there, where soil and climate seem well adapted to the perfect development of citrus fruits, and with an abundance of water for irrigation the development is likely to be rapid. In November, 1890, the special agent found in the Salt river valley preparations being made to plant more than 1,000 acres of oranges alone within 15 miles of the city of Phenix, and was told that the planting would soon begin in other sections on equally as large a scale, thus developing still another great "orange belt." However, the time of ripening of the fruit in the different "belts" is such as not to materially interfere with each other. Florida and Louisiana begin harvesting their crops the last of October or early in November; northern California and Arizona in December and January, while southern California comes in February and March and continues well into the summer, and with the perfection of earlier varieties for Florida and of still later or longer keeping ones for southern California there is reason to believe that the United States will in time eat its own grown. freshly picked oranges throughout the year.

A few trees of pomegranate, kaki, guava. pecan, pomelo, lemon, lime, fig, date, and banana were found growing for the family supply about farm and town homes within the semitropic belt, which may be roughly said to extend as far north as Charleston on the Atlantic coast and to the thirty-first parallel of latitude along the gulf coast, southwest Arizona, and in California as far north as the fortieth parallel, in full sight of Mount Shasta, with its perpetual snow and ice. Of course, it must not be understood that all semitropic fruits and nuts can be grown in all the country as far north as indicated, yet the kaki, fig, and pecan can be grown to a considerable extent outside of the limits indicated. Figs and almonds are grown to some extent in Oregon and Washington, olives on the Virgin river, in southern Nevada. and pecans in all the southern states. A few madeira nuts are also reported as growing on river bottom lands in Arkansas.

In addition to the home supply of fruits and nuts mentioned there were found growing 13.515 acres of almond trees, 677.50 of banana, 169.88 of citron, 9,864 of cocoanut, 4,477 of fig, 550 of guava, 1,362.25 of kaki, 7,256 of lemon, 495.58 of lime, 12,180 of madeira nut, 7,097 of olive, 184,003 of orange, 2,189.50 of pineapple, 171.89 of pomelo, and 27,419.50 of pecan trees, representing 658,566 bearing and 800,010 nonbearing almond trees. 577,782 bearing banana plants, 4,237 bearing and 14,110 nonbearing citron trees, 123,227 bearing and 1,199,549 nonbearing cocoanut trees. 138,186 bearing and 285,201 nonbearing fig trees, 32,943 bearing and 120,529 nonbearing guava trees, 58,390 bearing and 124,522 nonbearing kaki trees, 167,663 bearing and 498,784 nonbearing lemon trees, 19,096 bearing and and 44,255 nonbearing lime trees, 188,409 bearing and 411,248 nonbearing madeira nut trees, 278,380 bearing and 331,022 nonbearing olive trees. 3,885,890 bearing and 9,705,246 nonbearing orange trees, 21,750,000 pineapple plants, 3,279 bearing and 12,867 nonbearing pomelo trees, and 214,988 bearing and 657,980 nonbearing pecan trees.

Excluding pineapples and bananas, which are all counted as bearing plants, as they commence fruiting within a year of planting, it will be

noted that the average number of all nonbearing trees is about double that of the bearing trees, the value of whose product was $14,116,226.59 during the census year, divided as follows: almond $1,525,109.80; banana $280,653.75, cocoanut $251,217.41, fig $307,271.76, lemon $988,099.92, lime $62,496.90, madeira nut $1,256,958, olive $386,368.32, orange $6,602,099.06, pineapple $812,159.17, pomelo $27,216, and pecan $1,616,576.50.

On the basis of present prices, with all the nonbearing trees in fruitage, the next census ought to show a value of product of more than $50,000,000, and as the nursery census shows of young trees ready for planting 64,128 limes, 103,600 pomelo, 328,016 olives, 641,322 lemons, and 5,209,313 oranges, or enough to plant over 70,000 acres, a partial forecast may be made of what may be expected in the future, especially when these facts are studied in connection with the tables showing estimated acres of land thought to be suitable for planting with the various products enumerated.

NOTE.—Much matter of value in certain localities other than Michigan has been excluded from these pages, and much of detail that might interest a few specialists. These may obtain the bulletins in full, by addressing Supt. PORTER, or may eventually find the whole in the completed census reports.—SECRETARY.

PROCEEDINGS

OF THE

FIFTH ANNUAL MEETING

OF THE

MICHIGAN MANUFACTURERS OF FRUIT GOODS,

HELD IN THE COUNCIL ROOMS IN THE CITY OF LANSING,

JANUARY 12 AND 13, 1892.

PROCEEDINGS

The attendance at the meeting was the smallest of any meeting of Fruit Manufacturers since the organization of the society, owing principally to sickness and an unfortunate misunderstanding in regard to date of convention.

President G. F. ALLMENDINGER called the first session to order at 2:30 P. M.

The minutes of the last meeting were read, accepted, and approved.

The president then read his address, which was so full of interest and practical thought that we give it entire.

PRESIDENT'S ADDRESS.

We have gathered for the fifth annual meeting of our organization, which has grown stronger and more useful with each yearly meeting; and this fact, together with the fact that it has lived to enter into its fifth year of work, is good evidence that it is fulfilling what was expected of it by the Manufacturers of Fruit Goods of the state. We meet to greet each other, to pass notes on what our competitors in the world outside are doing, and to exchange information regarding our different modes of conducting business, and we find a couple of days in each year well spent in so doing. Our meetings will be successful only as each adds his part to the common fund of information, and each should endeavor to add something to this common fund. Thus only can we gain the largest possible profit.

By organized effort we have secured some advantages, and by continuance of effort we shall gain still larger benefits in the future. Reference is, of course, here made to matters of legislation, secured and attempted. A report of your committee on legislation, and a resumé of the situation for the benefit of those not familiar with it, will here be in order.

This association has declared itself to be in favor of a pure-food law, with provision for its enforcement by a commission. It believes that manufacturers who make pure jellies, pure vinegar, and honest canned goods, and the like, should not have their markets cut off by other manufacturers who sell spurious and cheaper goods under the name of pure fruit products. It believes, too, that the producer of fruit is interested equally with us, and invites the cordial coöperation of all horticulturists in the state. It believes that every person in the state, from the humblest worker to its wealthiest citizen, has a right to pure food, and that the sale of harmful food compounds should be prohibited. It believes that non-injurious preparations should be sold for what they are, that no purchaser be deceived in reference to what he buys. Harmful compounds, if generally used, must prove ruinous to the citizens of our state; and whether injurious or non-injurious, both kinds are made, and made only for the enrichment of dishonest manufacturers. Certainly no adulteration has ever been heard of which increased the cost of production. A trifling deduction from the cost of a pound or a gallon means a fortune for some one. In the state of Ohio alone, to deduct one cent per pound from the cost of cheese, and two cents per pound from the cost of butter, because of the competition of oleomargarine, and like products, meant a loss annually of one and a half million dollars to the people of Ohio alone.

This statement alone tells the story in its relation to honest industry. The unprinci-

pled manufacturer is enriched, and his competitor who tries to sell wholesome goods is forced into a competition which drives him from business. It is no wonder therefore that Ohio and Minnesota protect their dairy merchants; and no wonder that these states, in common with New York and many other states, have made provision that spurious vinegars shall not be sold as fruit vinegars, and not at all, if unwholesome.

These laws are almost identical with our own. What we now need is some provision for their enforcement, as, like all laws, they will not enforce themselves. A year ago your committee arranged to act with a committee from the State Dairyman's association, which had a bill drawn up and put into the hands of one of its members, who also belonged to the state Senate. Unfortunately for our cause, he was one of the two senators who were unseated. In the political squabbles which followed, the dairymen appear to have lost sight of their measure, and the bill was never introduced in the senate. In behalf of your bill the committee did what could be done. Under Mr. Foster's supervision it was entirely rewritten to conform to the Michigan requirements. It was introduced in the house by Mr. Rowden and a hearing arranged for a joint committee representing the dairymen and ourselves. We came to Lansing at the appointed time and were given about forty-five minutes, the day being one of those upon which a general political fight was in progress. Mr. Foster followed the matter up and finally, in response to his constant pressure, a favorable report was made by the committee on agriculture. It was then referred to the committee on judiciary, made up of lawyers from several cities who were not in fear of their country constituents, and by this committee tied up, though we felt confident of being able to pass the bill even against an adverse report, as we were assured that sufficient votes were available if it could only be put before the house. Defeat really took place because its friends allowed the bill to lie without action until the close of the session was at hand, and in deference to the belief of our governor that no new offices should be created.

With all respect to this belief, I venture the prediction that not one, but many, new offices will be created as the increasing needs of the times demand their creation.

A hundred years ago, the place of our meeting was a forest. It is safe to say that in that day a state inspector of insurance would have been a superfluity, either here or elsewhere in the state. The salt brine underlay Saginaw then, as now, but no salt inspector was necessary to mark the bbls. of salt as of proper grade, for the shipments of salt from Saginaw were still undreamed of. The savage took from stream and lake the fish necessary for his food, without let or hindrance, without a thought that some day an office and an expensive equipment would be found necessary to prevent the extinction of many kinds of fish from our waters. Time has brought the necessity for an inspector of insurance, for a salt inspector, and for a fish commission. We have them all today, and all are for the profit of the state.

With the adulteration of food now in vogue, time has also brought the need of a food commission, and, in spite of the reverse of last winter, we can confidently look forward to its creation. Too many of our neighboring states have such commissions to bar out unwholesome food, and too much of the food rejected by them is marketed in our state for Michigan, to remain passive much longer.

There was much that was encouraging in the failure of last winter. Many assurances of good-will were received. A large number of local organizations of Patrons of Industry sent in petitions, copied, I think, bodily from our own. As already stated, the dairymen united with us and will undoubtedly stand ready to do so again. Within a few weeks the state grange has taken decided ground in favor of a measure like ours. I think, gentlemen, you were first in asking for this law. Three other bodies are now working with you, and I recommend that you appoint a committee to work in harmony with them, to the end that all four bodies may be in perfect agreement on the bill to be pushed. This joint committee should arrange all details as to petitions and mode of procedure during the coming year, and be ready to push the bill through the legislature next winter.

I must apologize for taking so much time on this subject, but I believe it to be a most important one for us all. Some, who are evaporators of fruit only, may not agree with me. All such will agree that their most profitable years are when the great surplus of fruit in New York and other states does not come into competition with our own fruit. If the law proposed shall be passed, this surplus, I believe, will always find a market, and you will be relieved of its competition. You should then be able to find a market for your product, which in many years is a difficult matter as things now are. This increased demand can be for cheap fruit only, hence, in years of shortage, when prices are high, you will have no annoyance from it. You are, therefore, asked to heartily join in aiding the work of the vinegar men. In closing this subject, I submit a copy of the law last winter proposed by us.

A very similar subject is the one of national legislation. Last winter a bill regulating

or prohibiting the passage from one state to another, of impure food, received much attention. It has been reintroduced in congress and will be pushed this year. The Northwestern Cider Makers' convention which recently met at Springfield, Ill., recommended that each association appoint one member of a national committee to look after this matter and to aid in securing state legislation as well, and appointed Mr. C. C. Bell of Booneville, Mo., as their representative. I recommend that you name some member of our association to act as our representative in this national committee.

In our programme we take up several subjects not hitherto touched upon at our meetings. I recommend to your especial attention, the question of a proper display at Chicago at the Columbian Exposition. When the gentlemen who are to speak to us on this subject have been heard from, you will be in better position to take action in reference to this matter. I trust, however, you will not fail to take action which will insure our having a proper exhibit there. Never before has there been such an interest in this country in the acquirement of foreign trade. It is probably safe to say that never again will the manufacturers of fruit goods of Michigan have so convenient an opportunity to display their products to the foreign buyer, and this opportunity should be improved to the fullest extent.

Finally, gentlemen, I recommend that our time of meeting be again made the third Tuesday and Wednesday of January instead of the second, to avoid conflict of date with other associations. Some of our members have been much discommoded this year. Next year, you will all agree, I think, that our meeting must be in Lansing on account of the session of the legislature. I recommend that an invitation be sent, by some member who will attend the Toledo convention, to the Ohio association to meet with us next year, we on our part agreeing to meet at Toledo year after next with the Ohio and Indiana men. If we can have the aid of the gentlemen who have built up so strong an association in Ohio, it can only help give an impetus to our own association. I am certain that two joint meetings of this character will be most profitable.

The year just passed has not proven so satisfactory to some of us as other recent years, yet I trust it has not been without some profit to all of you. Out of each one's experience there should be something of information for the rest. With the hope that you will fully occupy the time, gentlemen of the association, the meeting is placed in your hands.

The topic, "Chemistry of Vinegar Making," was then taken up, and the following interesting and instructive paper was read by Prof. W. L. Rossman of the Michigan Agricultural college:

THE CHEMISTRY OF VINEGAR MAKING.

Acetic acid, the active principle of vinegar, was known at a very remote period. The aqueous solution containing from three to ten per cent. of acetic acid, known as vinegar, also contains small quanties of alcohol, ethereal oils, sugar, dextrine, coloring matter, and soluble salts. The nature of the other materials which impart the characteristic smell and taste, depends upon the kind of material from which the vinegar has been made.

The materials used to furnish vinegar by normal acetic fermentation are: first, wine; second, spirits; third, malt wort or beer; fourth, fermented juices other than wine; and fifth, sugar beets. The wines used are such as are of inferior quality and considered unfit for drinking as wine. The spirits used are chiefly the potato brandy of Germany and whisky in this country. These, when used for vinegar making, are so diluted with water and vinegar already formed that the alcohol content is reduced to from three to ten per cent. The malt wort used is exactly like that prepared for grain spirit manufacture. Cider from good, sweet, ripe apples serves for the manufacture of vinegar in this country. Perry vinegar, from pears, is made to some extent in England. Sugar beets are used to some extent in France.

The production of acetic acid or vinegar from all the sources mentioned is due to a process known as fermentation. The word fermentation is derived from *fervere*, which means to boil, and evidently owes its origin to the appearance presented by saccharine liquids when left to themselves. We observe a more or less disengagement of gas, which causes the liquid to effervesce or boil. The sugar disappears and the product becomes spirituous. This is alcoholic fermentation and was the first known.

The changes, from a purely chemical point of view, which take place in a barrel of sweet cider when left exposed to the air at a temperature of from 70° to 90° Fahrenheit, are very simple. First, the sugar molecule splits up into alcohol and carbonic acid gas. The change is represented by the following formula: $C_6 H_{12} O_6$ (fruit sugar) equals 2 C_2

H_6 O (alcohol), plus 2 C O_2 (carbonic acid gas). Second, the alcohol taking up oxygen from the air forms acetic acid and water. The formula is C_2 H_6 O (alcohol) plus O_2 (oxygen) equals C_2 H_4 O_2 (acetic acid) plus H_2 O (water). C_{12} H_{22} O_{11}, cane sugar.

The first of these reactions is caused by alcoholic, the second by acetic, fermentation. The determining cause of the first of these reactions will now claim our attention.

Alcoholic fermentation is only a particular instance of a chemical phenomenon of which living organisms are the cause. A living cell of beer-yeast possesses the property of resolving into alcohol and carbon dioxide, the altered sugar which penetrates through its membraneous envelope. If we substitute for the cell of beer-yeast a cell of lactic ferment, we still see the sugar disappear, but instead of alcohol and carbon dioxide we have lactic acid produced. Says SCHUTZENBERGER: "The transformation of sugar into alcohol and carbon dioxide, and the conversion of the same body into lactic acid, are chemical phenomena which we can not yet produce by the intervention of heat alone, nor by the additional agency of light or electricity. The force capable of attacking in a certain determinate direction the complete edifice we call sugar, an edifice composed of atoms of carbon, hydrogen, and oxygen grouped according to a determinate law, that force which is manifest only in the living cell of the ferment, is a force as material as all of those we are accustomed to utilize."

Beer-yeast when examined under the microscope is seen to be formed of very small spherical or ovoid globules. They are capable of reproducing themselves by means of buds or seminules, and belong to the vegetable kingdom. It is now very generally admitted that ferments are fungi.

PASTEUR, who has watched these cells multiply, states that in two hours he has seen two cells furnish eight, including the two mother-cells.

There resides in the organic living cell a force capable of breaking up the complex molecule presented to it as food. It makes no difference whether that cell is a part of a more complex structure, like a tree, or whether it is isolated like that of yeast.

The second portion of the reaction, by which the alcohol, by taking up oxygen from the air, changes into acetic acid and water, will next claim our attention. In this, or acetic, fermentation, we find not only the fermentable matter and the ferment entering into the reaction, but also that the oxygen of the air becomes a necessary body. In other words, acetic fermentation is a combustion set up by living organisms, which serve as a media between the oxygen of the air and the fermentable body. It has long been known that alcohol contained in fermented liquids, such as wine, beer, etc., will disappear under certain circumstances and give rise to vinegar or acetic acid, and that the air, or rather its oxygen, plays an important part in the reaction. It was upon this idea that the procees of rapid acetification, called the German process, was founded. In this process, use is made of a large oak vat from six to ten feet in height by three or four in diameter, furnished with a false bottom pierced with holes and placed about twelve inches from the bottom. Some inches higher, the circumference of the vat is regularly pierced with a series of holes passing entirely around it. These openings are inclined from without inward, so as to prevent the escape of the liquid. At the upper part another false bottom is placed, pierced with many small holes. The whole vat is closed by a cover furnished with a funnel, which can be closed. The space between the two false bottoms is filled with beech shavings. All being thus arranged, hot vinegar is poured into the vat. This filters through the shavings and serves to facilitate or set up the oxidation of the alcohol. All of this was done with the idea that the liquid should present as great a surface as possible to the action of the air. But, according to PASTEUR, the beech shavings act, not on account of their porosity, but because their surface becomes covered with a thin pellicle of micoderma aceti.

The many points of contact facilitates the action but is not the determining cause. To prove this, M. PASTEUR caused some alcohol diluted with water to trickle down a cord. The drops which fell from the cord, at the end of a month, did not contain the smallest quantity of acetic acid. If we repeat the experiment, after having drawn the cord through a liquid on the surface of which there is a film of micoderma, the alcohol which passes slowly down the cord will be changed to acetic acid.

If we allow any species of micoderma to develop itself on any organic liquid containing phosphates and nitrogenous organic matter, until the whole surface is covered, and then, by means of a syphon, draw off the nutritive liquid and replace it with an equal volume of water containing ten per cent. alcohol; the plant, placed under these abnormal conditions, will immediately set up a reaction between the oxygen of the air and the alcohol of the liquid. The acetification at first is very rapid, but after a time the reaction becomes retarded by the great acidity of the liquid. Its vigor can be renewed, however, by the addition of more alcohol and water. A time, however, comes, says PASTEUR, when the plant, becoming partly decomposed, itself communicates to the liquid, in consequence of the organic and mineral matter of its tissues, properties which serve as nutriment for the various species of micoderma.

The action then takes on a different phase. The alcohol and acetic acid disappear with great rapidity and the liquid becomes completely neutralized, because, as soon as the plant finds in the subjacent liquid nutritive principles better suited to its development, it sets up such an intense oxidizing action that not only the alcohol but also the acetic acid is converted into water and carbon dioxide. This complete combustion is sometimes noticed in vinegar and the vinegar is said to lose its strength.

Micoderma aceti, which forms the membrane found floating on the surface of liquids undergoing acetic fermentation, is formed of very minute elongated cells. Acetification always takes place at the surface, and, as soon as the membrane sinks, no further acetification takes place. The "mother" of vinegar is simply a mass of these plants which have settled to the bottom.

The paper was illustrated with experiments showing the injurious effects of many ingredients which commonly enter into the manufacture of trade vinegar.

W. A. HERRING of Jonesville followed in a few general remarks on cider vinegar, corn and wine vinegar, and pickling. He stated he had secured the best results in pickling with cider vinegar, although very satisfactory results had been obtained from corn vinegar of 45° test. He thought one of the greatest evils to successful vinegar-making was in transforming cider into vinegar too quickly. More time should be given for a thorough souring of the stock, and more time in oxydizing the latter process. He recommends the Revolving Generator process, being careful to keep all parts from overheating, thus preventing that musty flavor so often imparted to vinegars.

A very interesting discussion followed, opened by A. W. STRONG of Ionia, who said he had pickled extensively and had invariably obtained the best results from corn vinegar. His experience was that cider vinegar injured pickles and he would not use it under any consideration.

L. S. FOSTER, of the firm of MILLER, PATTINGAIL & FOSTER, extensive manufacturers and picklers, took exceptions to Mr. STRONG's recommendations. He would use nothing but cider vinegar of high test, and verified his statements with exhibits of several samples, one of which was one year old and possessed every requirement of a perfect pickle.

A. TUCKER of Ann Arbor reported to the convention the proceedings of the recent meeting of the Northwest Association of Cider and Cider-Vinegar Makers. Among other matters of interest presented was the following report of a committee, appointed at a previous meeting of said association, to consider the advisability of the appointment of a national committee. The following is a report of said committee:

REPORT OF COMMITTEE ON PRESIDENT'S ADDRESS.

Mr. President and Gentlemen of the Convention: Your committee appointed to consider and report upon the recommendations of the President, beg leave to report as follows: That the Northwestern Association of Cider and Cider-Vinegar Makers, assembled in Springfield, Illinois, December 15, 1891, in order to secure the co-operation of all similar organizations, take the initiative steps to secure the appointment of a committee of one person from each organized Cider and Cider-Vinegar Makers' Association, said committee, when so appointed by their respective associations, to constitute a national committee that shall take consideration of any and all matters pertaining to the interests of their constituents, and recommend to them, from time to time, such measures as their interests may demand. And, if the several associations shall so appoint representatives, this com-

mittee may organize for greater efficiency by choosing one of their number as president and one as secretary; and that this committee, through their officers, may devise and execute measures that shall have for their object the advancement of the interests of the cider and cider vinegar makers. But in no case can said committee obligate the different associations for the payment of money without their consent. And it is further recommended that, if this committee is appointed, they consider the propriety of a meeting of the cider and cider vinegar makers of the United States being held in Chicago upon some day, or days, during the period of the Columbian Exposition, and to provide a place for such meeting; and that all members of the different state and district associations, together with all other reputable cider makers and cider vinegar makers, shall be eligible to membership upon the payment of one dollar, the object of which payment shall be to defray any expense attending the holding of said meeting; and if a balance be left after paying such expenses, the members present shall be competent to decide what shall be done with it. The prime object of the appointment of this committee shall be to confer together and to recommend such action to the different separate organizations as the exigencies may demand, especially as pertaining to state and national legislation.

The convention, deeming the matter of sufficient importance, empowered the president to appoint A. TUCKER to represent this association and act upon the aforesaid national committee.

The subject of "Pure vs. Impure Foods" was taken up and discussed by a number of the members present, which resulted in a request that the president and secretary of this association sign and send to each of Michigan's representatives in congress an earnest indorsement of the Paddock pure-food bill.

At the evening session the matter of consigning goods was presented in an informal address before the convention by M. A. REYNOLDS, secretary of the State Millers' association. He said that, judging from what he could learn of the two associations, they were on about the same footing, and as a result of his investigations he would emphatically say "No." He had noticed that the miller who consigned his flour was very near the hands of a receiver. He would advise manufacturers of fruit goods to establish their own market and hold their products until paying prices were realized. As a result, less poor goods would find their way to the markets and a better demand would be created.

C. F. JOHNSON, a commission merchant of Chicago, being present, could not agree with Mr. REYNOLDS, and took decided issue, admitting, for argument, that the commission man was an evil. He said he was one of the necessary kind, as it was he who worked the market, advanced money to manufacturers without interest, and shouldered all the blame for poor goods. But let the consigners forward none but good goods, and be content with a smaller margin, and much of the present dissatisfaction would disappear. He said that it was one thing to manufacture an article and quite another thing to place it upon the market.

A lively cross-fire of words ensued between the gentlemen, which would be interesting to read but which was not reported.

A vote of thanks was tendered Mr. REYNOLDS for his remarks.

The secretary presented to the association a proposition from EDWY C. REID, secretary of the State Horticultural society, presenting several

reasons why the members of this association should become an auxiliary of that society. After mature deliberation it was decided that we become such an auxiliary body, and the fifty cents per member of the present membership fee be turned over to the treasurer of the State Horticultural society.

Moved and carried, that the next annual meeting of the association be held in the city of Lansing, on the third Tuesday and Wednesday of January, 1893.

A motion also prevailed to extend an invitation to the Ohio Cider Makers' association to meet with us at our next meeting.

Convention adjourned until 9 o'clock A. M. the following day.

The next meeting of the convention was called to order by President ALLMENDINGER, who presented to the convention MARK L. STEVENS, member of the state commission representing Michigan at the Columbian Exposition. Mr. STEVENS promised ample room for a creditable exhibit of Michigan's fruit products and recommended immediate action. Considerable interest was manifested by some of the members, and the following committee was appointed to work the state for an exhibit at the Fair: WILLIAM A. HERRING, Jonesville; C. H. GODFROY, Benton Harbor; H. W. DAVIS, Lapeer; A. W. STRONG, Ionia; S. MCFETRIDGE, Ida; W. O. GLEASON, Ovid; C. J. JOHNSON, Chicago; E. J. MASON, Grant; L. S. FOSTER, Lansing; PORTER A. WRIGHT, Davisburg.

The subject assigned to J. E. BULLEN of Leslie, "Evaporating Fruit by Hot Air Appliances," and to J. E. SELBY of Eaton Rapids, "Evaporating by Steam," were passed because of the absence of those gentlemen.

At the request of President ALLMENDINGER, Mr. JOHNSON of Chicago made brief remarks on evaporating apples and the most attractive manner of packing for market.

These remarks were followed by the president, relating a brief experience in the industry.

L. S. FOSTER read an interesting paper on vinegar generators, namely, the revolving and the upright, which was as follows:

GENERATORS: THE ROLLING AND THE UPRIGHT, AND THEIR ADAPTATION TO A LARGE OR SMALL BUSINESS.

In presenting this subject to this convention, what I have to say is gathered from my experience only in the manufacturing of cider and cider vinegar; and I hope that none will think that a certain rule must be observed under all conditions. So possibly what I have found to be facts would, under other conditions, be the reverse.

Of the rolling generators there are several types, and all that have any value as vinegar generators are covered by patents. The one which is in the lead of all others, and which is probably the best known to cider vinegar makers, is the Gould. The construction of this type of the rolling generator is simple and is covered by letters patent. The filling of the generator is beech shavings. Two one-and-one-quarter inch holes are bored in the center of the stave lengthwise, one hole on the opposite side from the other. Then, on the center of the stave lengthwise, and on opposite sides from which the holes are bored, are bolted the bearings necessary to revolve the generator upon. This, with a small frame for the bearings to rest upon, constitutes the generator.

The generator is now filled half full of the vinegar stock to be converted into vinegar, which takes about 64 gallons. The holes are plugged up and the generator is turned over and over several times, to fully saturate the shavings with the stock, after which the generator is left in an upright position, with the plugs removed from the holes, from six to twelve hours. Then it is turned half over with the holes plugged as before, after which the plugs are removed again. This is continued from ten to fourteen days, when it is full strength vinegar.

The vinegar is removed, stock replaced in the generator, and the same process repeated. The room in which the rolling generator is to be operated should be on the

second floor of the building, or on the first floor above the basement. This gives an opportunity to draw off the finished vinegar into tanks in the basement, and also gives an opportunity for placing small tanks on the floor above, into which the vinegar stock can be pumped, and then from there it can be drawn through hose into the generators. The generator room should be kept at a temperature of eighty to ninety degrees and should also have a free circulation of fresh air.

The upright generator is known to us in all shapes and sizes, square and round, and from a three and one half foot diameter to eight feet in diameter, and from eight to eighteen feet in length. Each variety of this kind of generator has its advocates who claim advantages on the variety they operate over the others. The upright generator can be filled with either beech shavings, corn cobs or straw. Very good results can be obtained from straw filling, but it wears out more quickly than cobs or shavings. It is very much cheaper than cobs or shavings, as it requires only about 2,000 pounds of straw to a generator, and the cost of labor in filling is about the same as with other material.

The generator being filled, there is a close covering fitted over the top of it, which is intended to keep out filth, which is a matter of great importance to the life of the generator.

Some vinegar makers distribute the stock over the top of the filling by placing a tub or barrel about one foot above the top of the generator and this tub is tapped in several places and faucets inserted and the stock is distributed from these faucets through wooden troughs to different parts of the generator. A good way is to place a head in the generator, six or eight inches below the top, and bore it full of holes. Then place an automatic dump on the head and let the stock flow into the dump, which will distribute the stock very well.

The upright generators should be blocked up on timbers or stone foundation, two or three feet above the floor, to allow of free access to all parts, that any leaks may be stopped, and to also allow of the discharge of the vinegar and a good opportunity to conduct it away.

The generator is tapped at the bottom and a hollow wooden plug is inserted to allow discharge of the finished vinegar, which can be taken care of in various ways. A tank placed in the ground and the vinegar conducted through wooden troughs to it, is a very good way to take care of it. The quantity and quality of vinegar made from an upright generator, depends upon the size of the generator, the care it has, and the quality of stock used.

The rolling generator has several points of advantage over the upright generator. First, it can be run for a few days or for a year, and then, if there be no more stock to make up, it can be drained out and left standing for almost any length of time without taking any harm; whereas, with the upright generator, it must be run continuously, otherwise it becomes musty and diseased.

In running a small or moderate business, the rolling generator has the advantage over the upright, in that the loss in saturating the filling is but from ten to twenty gallons, whereas, with the upright generator, there is a loss of from fifty to one hundred barrels, according to the size used.

The rolling generator also has the advantage over the upright as to loss by evaporation, there being but about two per cent. loss on the rolling and from ten to twenty per cent. loss on the upright generator.

The rolling generator does not require the constant care that the upright generator does, and it can be run with as good success by an inexperienced person as by an old vinegar maker; whereas, with the upright generator, it requires constant care, study, and experience.

The cost of the rolling generator, ready to operate, is about $30. The cost of the upright generator depends upon the size and the material used in filling.

Several rolling generators can be operated on the average cider-mill floor, for nine months in the year, and during the season of grinding and pressing they can be drained out and stored in the yard out of doors. This can not be said of the upright generators, as they require a room specially built to accommodate them.

There is not much difference in the quality of vinegar made from the rolling or the upright generator, although possibly the rolling generator makes vinegar a trifle nearer like the old method of making it in barrels, which by some is considered to retain more of the apple flavor and aroma.

The working space of the rolling generator is about 5x5 feet square on the floor, and requires a room about eight feet between joists. The working space of the upright generator varies, according to the size used, from 5x5 feet square on the floor and ten feet between joists, to 9x9 feet square on the floor and twenty feet between joists. The point of advantage which the upright generator has over the rolling generator is its adaptability to a large business, although the adherents to the rolling generator process

claim that, with the same number of dollars invested in each, the rolling generators will take care of as much stock as the upright generators.

So, everything considered, on a business of from 2,000 to 3,000 barrels per year, the rolling generator would, in my estimation, give the best results with the least cost.

The convention was disappointed in not hearing from H. W. DAVIS, on the subject of "The Refuse and Waste of the Evaporators: How shall we use them profitably?" the gentleman being unavoidably detained at home.

A resolution, introduced by A. W. STRONG, prevailed, whereby the secretary's office is made a bureau of information for the members of this association, in regard to size of crops, sales, exchange of machinery, etc., he to report any case he might discover where commission men are not doing an honorable business, and such other information as may be of value to manufacturers.

Moved and carried, that the secretary distribute the Horticultural Reports of 1890, in which the proceedings of this association appear, to all duly qualified members, and urge a renewal of membership for the present year.

The association then proceeded to the election of officers for the ensuing year. Messrs. C. J. JOHNSON and E. L. BUSH were appointed tellers. The election resulted in the appointment of L. S. FOSTER of Lansing as president; H. B. GEORGE of Coldwater as vice president; S. MCFETRIDGE of Ida as secretary and treasurer. Executive committee: A. W. STRONG, Ionia; W. O. GLEASON, Ovid; E. L. BUSH, Plainfield; H. L. DAVIS, Lapeer; ERWIN LAMB, Dryden.

The committee on exhibits made the following report:

W. A. HERRING, three samples of evaporated apples. Find one sample good; the other two appear to have been worked from low grade upward. One sample of sand-refined cider, fair.

Genesee Fruit company presents two samples of sweet cider of standard quality; one sample of pickles, very fine in appearance, but, in the opinion of your committee, impracticable for a pickler.

D. W. MURRAY, six samples of sorghum molasses, representing different soils and methods of manufacture, all of which are very fine goods, and we recommend more general attention to this industry by the people of this state; one sample of boiled cider and one of jelly, both of which were very fine.

A vote of thanks was tendered the council of the city of Lansing for the use of their room in which this convention was held.

The treasurer was instructed to compensate the janitor for his care of the same.

Convention adjourned to the third Tuesday and Wednesday of January, 1893.

TREASURER'S REPORT.

Lansing, Mich., Jan. 12, 1892.

Balance on hand, Jan. 21, '91	$66 69
Received from all other sources	35 50
Total receipts to date	$102 19
Disbursements as per treasurer's book	64 03
Balance in treasury	38 16

LIST OF MEMBERS.

H. B. George, Coldwater, Mich.
A. Tucker, Ann Arbor, Mich.
G. F. Allmendinger, Ann Arbor, Mich.
S. McFetridge, Ida, Mich.
D. W. Murray, Partello, Mich.
W. A. Herring, Jonesville, Mich.
A. W. Strong, Ionia, Mich.
Joseph Darwood, Dryden, Mich.
Edwin Lamb, Dryden, Mich.
C. J. Johnson, Chicago, Ill.
E. L. Prussing, 34 Wabash Ave., Chi., Ill
W. O. Gleason, Ovid, Mich,
L. S. Foster, Lansing, Mich.
M. Wade, Butler, Mich.
H. L. Howard, Irving, Mich.
E. L. Bush, Plainfield, Mich.
H. C. Davis, Lapeer, Mich.
E. Emmons, St. Johns, Mich.
O. S. Miller, Holly, N. Y.
W. H. Covert, Bath, Mich.

REPORTS

OF

DISTRICT AND LOCAL SOCIETIES

IN MICHIGAN

FOR 1891.

DISTRICT AND LOCAL SOCIETIES IN MICHIGAN.

WEST MICHIGAN FRUITGROWERS' SOCIETY.

OFFICERS FOR 1891.

President—JOSEPH LANNIN, South Haven.
Secretary—C. L. WHITNEY, Muskegon.
Treasurer—W. A. SMITH, Benton Harbor.
Executive Committee—WALTER PHILLIPS, Grand Haven; C. J. MONROE, South Haven; D. FALCONER, Saugatuck; J. C. GOULD, Paw Paw; J. B. HOUK, Ludington.

JUNE MEETING, HELD AT SUMMIT, MASON COUNTY, JUNE 16, 17, AND 18.

The summer meeting of this society was held in the fairest portion of the famous Michigan fruit belt, upon invitation of the Mason County Horticultural society, whose headquarters are at Summit, eight miles north of Pentwater and six miles south of Ludington, on the stage road between these two towns upon lake Michigan. It is the central point of an area of eighteen to twenty square miles of as fine fruit lands as can be found in the famous fruit belt of Michigan. These rich and well-located fruit farms are owned and cultivated by earnest, intelligent and successful fruitgrowers, who devote themselves to their calling. The many and large churches and school houses, upon good roads, speak volumes for the community.

Since the annual meeting in December, at which time the officers for the year were elected, W. A. TAYLOR of Saugatuck, who had then been elected secretary of the society, had resigned his office, having been appointed to a position in the agricultural department at Washington. The vacancy had been filled by the executive committee selecting C. L. WHITNEY of Muskegon, who entered at once upon the duties of the office.

At the appointed time, 2:20 P. M., Tuesday, the 16th, a large number were convened in the commodious and pleasant school room, which had been decorated with plants and flowers for the occasion. Plates of luscious strawberries and some winter apples were tempting to the eye, and bouquets of roses and other cut flowers graced the tables. Very conspicuous were the promises of the abundant coming fruit crop seen in the heavily laden branches of peaches, plums, apricots, apples, cherries, pears, gooseberries, currants, etc., in their present green state.

President JOSEPH LANNIN of South Haven, called the meeting to order and the business of the occasion began. After prayer by a resident clergyman, reports upon the condition and prospects of the fruit crop were made

by the representatives of the several localities. These reports were full of interest at the time, and gave useful information regarding the liability to frosts upon low lands and the sensitive nature of the peach upon such lands.

Mr. ADAMS of Shelby had lost his plums in the lower part of his orchard, while a row but five feet higher was bearing full; spring frosts hurt the plums more than the peaches; plums will stand harder winter freezing than the peach.

T. RESSEGAR of Carter said seedling peaches were doing as well as plums.

Mr. MEISENHEIMER thought the condition of the plum at the time of the frost had something to do with its killing.

The reports being closed, the president named the standing committees as follows: Upon resolutions, A. HAMILTON, J. L. HOPKINS, D. FALCONER, and L. B. ROSE; on fruits and flowers, C. L. WHITNEY, WALTER PHILLIPS, and J. B. HOUK.

G. C. MCCLATCHIE, president of the Mason County Horticultural society, opened the evening session by a hearty address of welcome to all attending, to which Secretary WHITNEY of Muskegon and WALTER PHILLIPS of Grand Haven responded in well-chosen words fitting the occasion.

Mr. PHILLIPS then presented the following paper upon "Marketing Fruits":

First, it will be admitted by all fruitgrowers that at certain times of the year our leading markets—Chicago, Milwaukee, Detroit—are so oversupplied with fruit that the net returns hardly pay the growers for raising, packing, and shipping. This will not apply strictly to the growers that always put first-class stock on the market; for the market is seldom if ever oversupplied with first-class fruit. But it will apply to the great bulk of our fruit placed on the markets.

In consequence of this state of things, we are told that the fruit-raising industry is largely overdone. This may be true in certain lines, but will not apply to energetic, active fruitgrowers who raise first-class fruit and put it on the market, honestly packed in a clean, attractive package.

We are willing to admit, however, that in any of our markets, at any time when there is a large supply of fruit, graded as common stock, it has a tendency often to drop the price on good stock.

Now, as a remedy for oversupplied markets, and also to enable us to obtain better prices for our fruit, I would recommend, first that we grow fruits of good quality; second, we should not only have our fruit trees and vines in a vigorous, healthy, bearing condition, but we should thoroughly and evenly distribute the fruit over the tree and vine that the fruit will be not only of good quality but also of good size and first-class general appearance.

Again, I would recommend, in planting fruits of whatever kind, that we plant a succession as regards their ripening and coming into the market.

Again, we should not only have fruit of good quality, good size, and first-class general appearance, but said fruit should be packed honestly and in clean, attractive packages, be handled carefully, and arrive in market in good condition. And after all the above has been complied with, the great problem to be solved, to enable the wide-awake fruitgrower to get a fair margin on his capital and labor invested is a more thorough and complete distribution of his products direct to the consumers.

Our present system of distribution is so defective that it leaves one half of the families in the states lying west of us, where fruit is not grown to any large extent, without any fruit at all. Also, under our present system of distribution, before our fruit reaches the consumers in the west it pays a heavy toll in Chicago or Milwaukee; and this is not all, the fruit being delayed in transit at these places, and also in being handled and shipped. Consequently it arrives in the western markets, at the homes of the consumers, in a damaged condition, and sells at prices too low to leave any margin to the fruitgrower. For, remember, in the end, invariably all of these losses are charged up to the hard-working producer.

I would recommend, first coöperation of fruitgrowers in the form of organization for the purpose of more evenly distributing our fruits direct to the consumer, and also the marketing of the same under well chosen rules.

In case the above plan is not feasible in your locality, where you are engaged in growing fruit, in case you are growing on a small scale, my advice is to depend on home market. Sell direct to the consumer. On the other hand, if you are largely raising fruit for the market, my advice is, if coöperation will not work in your locality, by all means do as I did last year—strike out for yourself. Find a good market for your products. There are at the present time hundreds of towns all over the great northwest where good, fresh, first-class fruit is never seen—towns ranging in population from five to twenty-five thousand inhabitants—towns in many cases largely engaged in manufacturing and mining industries, consequently money is reasonably plenty, and fruit sells well if fresh and good.

Now, when you have found your market, go to Chicago or Milwaukee, as the case may be, and look after your transportation rates. This is an important item. Look after it well. If you have a good amount of fruit to ship, invariably you can get good rates. At least this is my experience.

Now, when all the above plans are perfected, be sure you have some one at your place of raising fruit that can be depended upon to put up the fruit as I have recommended it to be put up, and you at the other end of the line, see entirely to the marketing, and I will guarantee, as soon as your brand is known well, you will have no trouble in disposing of all the fruit, at good prices, you can raise.

In conclusion, let me remind you that this is a day and age of competition and specializing in all industrial occupations, and in lines of general business, and none but those who have special fitness and special training can hope to make a success. Therefore, let us make our calling a specialty, and bring to bear upon it our best thoughts and best industry as well."

The paper was followed by an interesting and instructive discussion, in which Messrs. HAMILTON, ADAMS, WHITNEY, LANNIN, and others took part, all agreeing that organization was needed and that well-grown, properly packed fruit was seldom a drug upon the market. Some claimed that distribution must be made through the usual channels, by the aid of the commission houses, while others held that the growers must seek the market directly to the consumers.

The question-box gave several important questions which were fully discussed.

"What size and kind of package should be used for shipping fruit?" The Oceana and Mason county people claimed that the fifth-bushel climax basket is now the best, while those of Allegan and South Haven thought the full peck basket the best.

"Can gooseberries be raised at a profit, and was there a market for them?" was answered in the affirmative.

At 9 o'clock Wednesday morning the society again convened, those from abroad having been gathering lessons as well as fruit from the well-tilled fields of their hosts. President LANNIN opened the programme by a talk upon pears. He considered the following varieties the most profitable for planting: Madeleine, Clapp's Favorite, Bartlett, Louise Bonne, Sheldon, Anjou, Bosc, Seckel, and Lawrence, and mentioned some of the new varieties, giving the value and faults of each. Many questions were asked by those present and answered by Mr. LANNIN.

The subject of the recent legislation in the interests of fruitgrowing and bee-keeping were brought up and the several bills before the legislature were read and discussed. The policy of senate bill No. 78, file No. 30, was greatly questioned, yet it was thought the intelligent fruitgrower would not spray his trees until the blossoms had fallen, notwithstanding wise, theoretical teachers had instructed them and many others to spray when the trees were in bloom. The bill for the suppression of yellows and black-knot, now pending in the legislature was heartily endorsed.

The afternoon session was given up to papers and discussion. The first was by A. A. ADAMS of Shelby, upon "Peach Culture and the Best Varieties to Plant."

The importance that the growing of fruit in Michigan has assumed for the last few years, with the fact that I have been interested in it for several years, has induced me to respond to the invitation to give a paper on this subject; and as I have had more experience in growing the peach than any other kind of fruit, I have taken "Successful Peach Culture" as my text.

Now, if I were to write about the failures of peach-growing, it would be much easier for me. There are many things that enter into this subject that go to make up the successful fruitgrower, some of which I will mention.

First, location, one of the most essential. I need not tell these older fruitgrowers this, for most of them can remember back when most of the orchards in the interior of the state were frozen to death, which left the lake shore country the peach belt of Michigan. I need not tell that all the land on the east shore of lake Michigan is adapted to growing the peach, for that is not a fact. My choice for success in growing the peach would be to get a high elevation (I do not think there is any danger of getting too high in Michigan) within the influence of the lake. Now, there are exceptions to all general rules, and last season was the exception. There were more peaches on the lower land last year than on the elevated locations, while this season the same orchards are an entire failure. That a north or west slope is preferable has been proven for the past two seasons, but as all who wish to engage in the business can not get a north or west slope, an east or south will do if you only get high enough. Now, unless we can get a crop four years out of five, commercial peach-growing is not a success, for reasons which we will not stop to enumerate.

Second, success depends upon the proper management of an orchard, namely, planting, pruning, thinning, picking, and marketing. It is supposed that any one who can dig a hole can set a tree. That may be a fact, but I am of the opinion that the one reason so many trees die the first season is, that they were carelessly planted, and those that do pull through are feeble for the first year or two, which I think the most important period in the life of the peach tree. Like a stunted pig, a misset tree seldom if ever recovers. Again, I think as much depends upon knowing how much or how little to prune a peach tree as upon any part of orchard work. I think there has been many a promising orchard very much injured by trimming too much, trimmed to death. I have in mind several orchards which started out very promisingly, and were kept trimmed up so there was no fear of breaking limbs in cultivating, and the inside taken out so as to give the tree plenty of air and sunshine; but they never made successful orchards. I could see no other reason than that they were pruned too much. It is my opinion that we should study the habits of different kinds of peach tree to know whether they are upright growers or whether inclined to droop, or of a sprawling habit, at the commencement of pruning, of which I would do but little until the second year after planting. Then commence to form the head. Then, if an upright grower, like the Crawfords and Mixon, there is danger of getting them too high for convenience in picking, which may be avoided to a certain extent by keeping them cut back from the top, while the Chili, Barnard, and all that class will need to be coaxed up to get them out of the way of the team, which may be done by trimming from below. I blieve that a peach tree of an upright habit may be so pruned that, with good soil and proper cultivation, it may be made to bear, at twelve years, ten bushels of fine peaches, and need no propping. But an orchard left to grow for four or five years without pruning, can never be made a successful one.

As the demand is growing more every year for fine fruit, and as we in Michigan have to compete in our markets with most of the peach-growing states, we have more yet to do to secure the best prices, which is very essential to success; and, in order to get large fruit, trees that do over bear must be thinned. I believe no definite rule can be given in this regard. One successful fruitgrower of South Haven recommended thinning to four inches. That was several years ago; but, like us, further north, he has not been bothered much with thinning for a year or two past. I think the best plan is to use good common-sense this season. Study the conditions, the vigor of the tree, the soil, cultivation, and variety, then your own disposition. If you are inclined to be a little greedy, hire your help, telling them what you want of them, and go to the house, but keep your eye on them. We should not count the expense, for money spent in that way will bring back good interest. We can not be very successful without thinning in a full bearing year.

The starting point of an orchard is the tree. A tree may be all right in caliber, have good roots, alive and in good condition for setting, yet be worthless to the planter for several reasons. The varieties may not be adapted to the location in which it is to be planted, which means failure. A kind may be too late, or "shy" in bearing, which makes it worthless in a particular locality, and many varieties will come to the planter highly recommended by some oily-tongued tree peddler who knew nothing about differ-

ent varieties, and cared less, so long as he made the sale. I would lay considerable stress on peddlers, for there are many who recommend such varieties for general planting as the Foster, Susquehanna, and Wonderful, which are perfectly worthless in any part of Michigan that I am acquainted with. Beautiful to look upon is the Foster, when you chance to see it, but it is too shy a bearer, and so are the other two named. To illustrate, a man of my acquaintance was induced by some knowing tree peddler to purchase 1,600 Foster peach trees, not by any fruitgrower of experience. With soil the most favorable, and with good care, he, I think, has had but two or three crops in eleven years. That, you see, was not much of a success. Now, in order to secure the best results from the peach orchard, a succession of varieties is important, and we have enough well-tested sorts to meet the demand, some of which I will give; viz.: Alexander, or Waterloo, which are about the same, is about as good as any for early; Early Rivers, which in our vicinity does well, and has proven very prolific and hardy; Hale's Early, an old and well-known sort; Honest John, yellow; Jaques Rare Ripe; Early Barnard, or Snow's Orange, either one or both; Lewis, a peach which originated in Ganges, Allegan county, hardy and productive, coming just after Hale's, of fine appearance and fair quality; Stump-the-world and Oldmixon, both ripening about the same time, both old and reliable kinds; then the Chilis, well known to all who have heard of peaches, and lastly Smock. In some locations the Smock might not be profitable, but on any warm, high elevation it will pay, for it will ripen in our latitude four years out of five. I would not set any peach later than the Smock.

Now, with all the above named conditions adhered to, peach-growing may be a success. We have had but four entire failures of peaches in the peach-growing district of Michigan in twenty-seven years, one in 1864, again in 1875, again in most of the peach districts in 1889, another universal one in 1890.

This paper was followed by one by J. G. RAMSDELL of South Haven, upon "The Peach Orchard," read by Secretary WHITNEY in the absence of the author.

These two papers brought the whole subject of peach-growing before the meeting, and elicited much discussion, in which Messrs. HAMILTON, FALCONER, ANTHONY, MCCLATCHIE, GEPHART and others engaged, bringing out many important facts, the results of years of experience by practical men, which edified and instructed all present.

H. ANTHONY of Hart read an interesting paper upon "The Origin and Culture of the Orange Quince." This subject was a new one to many and was ably handled by Mr. ANTHONY, whose paper was followed by some discussion. All agreed that the quince could be successfully cultivated and at a profit. We regret that this valuable paper is not at hand for publication.

The evening session was the best attended of any, many having to stand during the meeting.

The question box gave the question, "Does it pay to plant currants for for market? What kinds?" Decided, yes; and the Victoria and Long-bunch Holland are the most satisfactory.

An instructive discussion upon "Plum Culture" was largely engaged in. Mr. MARKHAM of Hart said that had he known twenty years ago what he knew now, he could have made a success of plum-growing. He would plant Union Purple, Lombard, and Bradshaw. Some did best one year while others paid best other years. He gathered his plums when ripe, picking only the ripe ones and leaving the others to ripen. He used the shears in gathering, cutting the stems. A word to the wise. It should lead many to see this point and not pull off fruit.

Judge F. J. RUSSELL of Hart spoke of his success in spraying his apple orchard—thought it easy when properly managed. Others spoke of failures in spraying by getting the mixtures too strong. All should go slow upon the use of mixtures recommended by theoretical men. Experiment lightly until you are sure you will not kill your trees as many have. Pear, plum, and peach will not bear as strong an insecticide as the apple.

"Fruitgrowing in Mason county," was presented in general by L. W. ROSE, who gave some interesting facts and figures which this year's crop will largely increase. Mr. MCCLATCHIE followed, speaking of his success in plums. He said colored plums sell best. The profits in plum culture are good. Mr. HITCHCOCK gave his experience in the growing of raspberries. He grew the Brandywine and Cuthbert for reds and the Gregg for black. Mr. MEISENHEIMER spoke of peach-growing in the county as profitable—he had made money from the peach. The Alexander was most profitable, some thought the Wager peach the most profitable. Others spoke of the advantages of the locality, many of which were apparent to the observers present.

Secretary WHITNEY read an extract from a letter from the Hon. S. S. BAILEY of Grand Rapids, as follows: "If I were present at your meeting I would ask this question: How long will it be before some of our western or northern fruitgrowers will produce and introduce a hardy, early, reliable strawberry? The Cloud was introduced from the south as being the earliest and best known berry for a long time. At the north it has lost most of its claim for earliness and all its claims for quality and quantity. Will Michel's early share the same fate? Does not a southern fruit lose its habit of earliness after a few years when grown further north? If so, we must look to some northern man to give us something that will stay by us, and are paying too much money for that which comes to naught after a few years' trial. You may induce some one to make the trial. Here is food for thought and incentive to action."

"Does the plum succeed best upon plum or peach stock?" was a question taken from the box. Many growers thought the plum not best on the peach, but such trees do not sprout so badly. Those on the peach should be set deeply and place the peach stock below the action of frost.

"Is peach-growing in the future likely to be as profitable as in the past?" Answer—Yes, if proper care be taken of the orchards, for there was a large population to consume the product, and only a limited territory upon which the fruit can be grown.

After many other questions, at a late hour the meeting adjourned to meet again at 8 o'clock in the morning and complete the labors of the session.

On Thursday morning nature presented a clean face, having been washed by a welcome and much-needed rain during the night. The first business in order was the reports of the committees. The committee upon fruits and flowers made a long report, giving a long list of the varieties shown either in a ripe or green state. Of course, most of the fruits could be shown only green, as they are growing upon the branches. The Warfield No. 2 strawberry was fine, also the Bubach and Wilson. J. D. ROBINSON of Hartford showed some fine samples of the "Late Red" apple.

The committee upon resolutions reported as follows:

Resolved, That we most heartily appreciate the cordial invitation received, followed by the cordial welcome we have had at the hands of the Mason County Horticultural society as a body, and the generous hospitality accorded us by the various members, entertaining us at their several homes, for all of which we most truly do thank them.

Resolved, That we know of a verity that this part of Mason county is truly located in and is an important part of the famous fruit belt of Michigan. Their lines are cast in pleasant places, where soil, protection, elevation, and all the essentials of successful fruitgrowing are accorded them, and may they long rejoice and be happy therein.

Resolved, That we shall long treasure in memory this meeting and visit to Mason county, and often with pleasure and profit recall the lessons learned and enjoyment had while at this session of our society. May the blessings of health and abundance ever be yours.

The report was unanimously adopted. Under unfinished business the question of "how to detect yellows in the peach" was asked and answered by those having experience in the southern part of the state. The president gave some excellent words of advice to those present in regard to the care of the growing orchards, the preservation of the protecting timber, that they might not have the sad experience of many in the older portions of the state. Then came adjournment, hand-shaking, and good-byes, and the guests departed to their homes, feeling that they had had a most pleasant and profitable time.

THE ANNUAL MEETING.

The seventh annual meeting of the West Michigan Fruitgrowers' society was held at Grange hall, Ganges, Allegan county, Dec. 17-19 and was very largely attended by the local growers as well as by those living all along the "belt" from Benton Harbor to Oceana county. There was a fine display of apples, some sixty-seven plates and baskets being on the table, as well as a few pears and Salway peaches. The president of the local society, Hon. D. W. WILEY, and Secretary O. S. BUSH, as well as many of the members, were very efficient in caring for the guests from a distance, and the ladies came in for a good share of praise for the abundantly supplied, nicely arranged, and neatly served tables at the dinner, of which about 175 partook. The local choir enlivened the occasion by music and song which was greatly appreciated. Ganges is the center of the Allegan fruit belt, and the numerous orchards, fine residences, and the thrifty appearance of the country show a well-to-do and enterprising people. It was reported that about 4,000,000 packages of peaches were shipped, realizing about $1,000,000.

The meeting was called to order by President LANNIN and after invocation by Rev. Mr. KITCHEN, an address of welome was made by Hon. D. W. WILEY and a response by President LANNIN. The annual address of President LANNIN was a well-delivered speech in which he discussed the necessity of fruitgrowers' societies and the bringing before each society the matters pertaining to the section in which the meetings are held. We as a fruitgrowers' society keep strictly to the business of fruitgrowing; and while we have gained considerable knowledge, we have yet to learn many things. Nature has yet many secrets locked up in her storehouse. The World's Fair was alluded to with a promise of having the subject thoroughly discussed, and he spoke of the necessity of all societies working unitedly to make the exhibit of fruitgrowing in Michigan a success.

In his report the secretary said the society had a successful and valuable meeting in the summer, and he hoped to improve in each meeting. Receipts of June meeting were $15.65; paid out at that time $12.90, and for this meeting $7; balance, minus, $4.25.

Committees were thus constituted:

On Fruit—W. A. BROWN, A. ADAMS, A. S. PACKARD.

On resolutions—F. J. RUSSELL, WALTER PHILLIPS, J. A. PEARCE.

The topic, "Success and failure of fruitgrowing in 1891, and the lessons taught thereby," was taken up.

Mr. W. S. GEBHART of Mears: My experience is limited. I had about 500 bushels of peaches. By going to large markets I get the lowest prices. I prefer to send to smaller places.

Mr. J. A. PEARCE of Grand Rapids: Our greatest success was with grapes, for which we took prizes at the Grand Rapids fair. The pruning was on the renewal system; fertilizers, lime and ashes. Our peach orchards were injured by early frosts, perhaps from starting cultivation early. We supply home markets first, then go to other markets. We organized a growers' society and tried to get in communication with outside buyers. I think location has much to do with grapes. High elevations seem best for grapes. Three or four barrels of lime and four times as much ashes per acre are used. We received about $1 to $1.25 per bushel.

Mr. R. MORRILL of Benton Harbor: The season was generally successful. We are all-around growers of fruit from first to last; then of vegetables. We were only short on apples. Some $18,000 were paid for cider apples.

Mr. A. S. PACKARD of Covert: In a general way, I will say that this was my first crop of peaches. I had 4,400 bushels, most of which I shipped to Chicago. I sold about 500 bushels on orders and 1,200 in the orchards and for these I received more than those sold in Chicago.

Mr. O. BEEBE of South Haven: I have done pretty well on the whole. Crops were good with the exception of apples. Pears were a medium crop. peaches a large one; plums, about the first I ever got; grapes, extra, but low in price; yet on the whole, the large quantity of fruit, even with low price, made a fair margin. We distributed more generally through the state than ever before.

Mr. WALTER PHILLIPS of Grand Haven: Successful fruitgrowing depends largely upon the net cash we get for fruit. We made a success in raising fruit, but any failures were in the direction of marketing. Those who staid at home and packed their fruit as well as possible, and then sent to large markets, did not do so well as those who sent their fruit to interior places; and I believe that success with fruit means to send it all over the northwest to those who have but little near home.

Mr. JAMES GARDINER of Ganges: I differ from the last speaker in saying Chicago is a poor market to send fruit to. After thinning my fruit I sat down to count the cost of marketing. Not all the Chilis were fit to ship, but where I thinned the most I got the best peaches. I sorted to three sizes and dried the culls. I shipped to Chicago and was well satisfied with the results.

I hear a great deal about Chicago commission men, but I think some of them are just as honest as any class of men. The fruit crop in this town was not so large as expected, but we received a good price for what we shipped.

Mr. EDWARD HUTCHINS of Ganges: I think I failed this year in not having more trees set out. Our experience has been that Chicago has been our best market. We have tried shipping west to save Chicago commissions, but by the time I got my fruit there, others had too, and the market was down. One secret is shipping regularly to one or more men, and in a glut the commission man holds up his regular shippers. We have had no marked successes or failures but have kept along in about an average.

Mr. J. B. HOUCK of Ludington: When I came into this section and heard of 75,000 baskets shipped by one man, I felt that our small shipment did not count: but we thinned our peaches twice and had fine crops

and good prices—$1 per bushel, net. It costs us just 15c to place our fruit in Milwaukee. Plums bear every year. I bought the product of an orchard for $1 per bushel and cleared $1 on each bushel, and that was a success. Some shippers put in knots and leaves, and when they get their returns we laugh at them.

Mr. C. J. MONROE of South Haven: I have had a wide experience in the line of fruitgrowing, and I think that for the amount invested there is more profit in fruitgrowing than in any other general business. It was a succcess this year, but I think we must look well to the matter of thinning for fear of bad results in the future. In the matter of marketing I think, taking all things into consideration, there is but little difference in results in shipping to Chicago or to smaller interior markets. It is a great mistake to ship to many parties. Better take one commission house and pack the fruit so as to make a reputation. I shipped to only one man in Chicago and my peaches netted me a little more than one dollar per bushel.

Mr. C. L. WHITNEY of Muskegon: I think we should take notice of this thinning of peaches. If you take the flesh and the pit and reduce them to ash, you will find much the larger part of the volatile oil in the pit. Formation of the pit exhausts the tree and soil and the sooner a tree is thinned the larger the peaches and the less the tree is exhausted.

The next topic was "The fruit exhibit at the West Michigan fair: its quantity and quality, and how to be improved."

Mr. WHITNEY: I have taken the pains to examine the books and get the facts. I never saw so fine an exhibit. The table extended nearly quarter of a mile, plates six in depth, with large quantities under the table. The whole number of entries was 890, by 855 exhibitors, and $740.75 in premiums were awarded. There were of collections 455 plates—325 plates of apples, 95 of pears, 48 of grapes, 60 of plums. Total of single plates, 1,168; and 48½ bushels of apples competed for a single premium, all west Michigan fruit.

Mr. LANNIN: The greater part of the early fruit brought from a distance suffered by the heat, but the quality of the fruit was excellent. Mr. GEBHART of Oceana county had some of the finest plums I ever saw—finer than I ever saw from California. The finest apples I ever saw were from Old Mission—perfect, and by the bushel. The peaches were also fine. Mr. PEARCE of Grand Rapids exhibited the finest Delaware grapes I ever saw. Some bunches weighed nearly a pound. Pears I claim to know something about, but I was astonished at some Flemish Beauties from up north, and I think if we can exhibit such at the World's Fair we will astonish some of the other states.

A paper was read by E. HUTCHINS, on "Transportation and marketing fruit," which is here given in full:

The subject of the transportation of fruit is one of great moment to the grower. The older settlers will remember the time when peaches were allowed to go to waste in the small orchards then cultivated, because transportation facilities were lacking and the home market was inadequate. Sometimes, indeed, an intrepid buyer would hazard a shipment in one of the sail vessels then frequenting the coast; but the risk of losing the fruit before it could be landed across the lake was too great to warrant the pursuance of the business continuously. Occasionally, on account of high winds, the fruit would decay at the dock before a boat could land; and in comparatively recent years orchards planted in some portions of the south have been wholly unremunerative because rates of transportation were too high to leave any profit in shipping the fruit. In the state of Texas whole peach orchards have been cut down, because

freight rates could not be obtained that left any margin for profit in selling the peaches.

In western Michigan, however, our former difficulties have been removed, and the competition between railroad lines and steam navigation on the lake has produced a rate under which our fruit can be profitably handled during the entire season, and still leave, as we have every reason to believe, a very satisfactory profit to the transportation lines.

But it is believed that there is still room for improvement. The present status of the question presents three points that demand our attention. The matter of first importance is promptness of delivery. It is most essential that the fruit be delivered by the carrying lines at an early hour in the morning, if taken to Chicago or Milwaukee, our general markets, so that it may be placed on sale during the best market hours. It is probably a safe estimate to say that in one day during the season just past, a loss of ten cents per package was entailed on the growers of this vicinity, because a train of seventeen cars, containing upward of 30,000 packages, did not deliver its fruit in Chicago until nearly noon. This was an aggregate loss of at least $3,000. Another desideratum is careful handling. Ripe fruit in particular is greatly injured by rough handling, and unquestionaly the fruitgrowers of western Michigan have sustained a greater loss than, perhaps, they are aware, on account of the practice the employés of transportation lines have had of pitching the packages into and out of the cars. Those in the vicinity of Fennville are more fortunate than heretofore on this account because of the arrangement they made with the C. & W. M. railway company to load and unload their own fruit. So with us this evil is largely overcome, but still there is room for improvement in this particular.

The third question—and the one which is engaging the attention of our fruitgrowers more largely than any other—is the matter of freight rates. During the season just closed the managers of the C. & W. M. railway have shown a disposition to deal very fairly with the shippers along their line, and have made very generous concessions in the way of reduced rates.

As a result, peach-growers near Fennville have been able to effect a saving over former rates nearly great enough to pay the expense of picking and packing their fruit. Very naturally, therefore, a very cordial feeling exists between the growers and the railway company. But with all we have gained in this line we are still paying not far from the rate that peach-growers in southern Illinois are granted on a haul of three times the distance from Fennville to Chicago. It is understood that better rates could be doubtless secured if the C. & W. M. railway company controlled the entire line to Chicago instead of having to run their cars part of the way over the Michigan Central tracks. It is a question worthy of due consideration, if it is not advisable to encourage the managers of the C. & W. M. in their effort to transfer our fruit to boats at Benton Harbor, so far as is practicable, until a lower rate can be secured on an all-railway line to Chicago.

Along the lake shore the peach-growers have been rather less fortunate in the matter of rates than their Fennville neighbors. Early in the season the boat owners united in fixing the rate at five cents per fifth-bushel package. Many of the growers considered that unnecessarily high, and boats were engaged to carry the fruit at four cents per fifth basket. Although this was one half cent above the railway tariff at Fennville, as well as that to which the other boats cut as soon as the fruitgrowers' line was fairly established, still the effort proved fairly successful so far as docks could be obtained.

Conditions in other localities are different from those prevailing in this vicinity; but the three general principles indicated obtained throughout the west Michigan fruit belt.

The best method of obtaining these demands may well engage our attention. The first essential toward gaining our ends, that might be noticed, is organization. Organization should be entered into, not for the purpose of war, but to prevent it. The fruitgrowers should organize in order that they may deal with lines of transportation and be dealt with. In a word, this method should be adopted because it is the one instrument generally recognized and made use of in successful business affairs.

And the importance of each fruitgrower's taking a personal interest in the matter of organization can not be too strongly urged. The benefits gained by the Fennville Fruit-shippers' association are generally recognized. There is not a fruit-shipper in the vicinity, no matter whether he favors the action taken by the shippers or not, who has not gained financially on account of the work accomplished through this organization. Very few of us, indeed, would like to see it suspended. And yet it will not continue unless a sufficient interest is manifested in it to do so. And most assuredly its work will not continue unless the organization is kept up. No fear need be indulged about the

probability of its suspension, for there are too many interested in it to allow it to die just yet. But let us suppose that a meeting is called for the purpose of keeping this body intact and in working order. The appointed day proves a fine one, and the members of the association severally conclude that their absence will not amount to much, and they have some little job that they can do on that day. Each thinks there will be enough there without him. When the meeting takes place there is not a quorum present. No business can be transacted. Suppose another meeting is appointed and turns out the same. What is to be done? The association will go down, and its work will stop, or a new organization must be formed with a less number of members.

These latter will naturally argue that if the fruitgrowers did not have sufficient interest in the old organization to keep it up, they are not especially entitled to any of the benefits of the new one, and as it costs time and attention to keep up the work, they will simply put the returns from any further concession they may gain into their own pockets. The general grower will thus be deprived of any gain that he might make by taking the personal interest in the matter that he should. Perhaps it may not be very politic to say it; but this instance is not wholly imaginary.

It seems necessary, therefore, to urge most earnestly the importance of all such efforts. The individual benefit derived from attendance at such meetings may perhaps be small, but still it is important.

The pupil in the school only learns a little each day, and that, too, perchance, by the hardest effort; but the total sum of those daily "littles" amount to an accretion of inestimable value. We are none of us too old to go to school yet; and the little we may pick up at the meetings of these various organizations may prove of far greater value than we think, and we may be assured that the moral effect of our attendance will not be without its influence upon others.

Mr. Phillips: Organization moves the world. Some think they can, single-handed, manage this business, but it can be better done by organization. A better distribution of products brings better prices to the growers. First, plant for a succession for market; select good fruit and pack nicely, and ship if possible direct to the consumer; put your name on the package and you will soon get a reputation. Chicago is the great market center of the west, yet there are many places in the west where they never saw a good Crawford peach. At Duluth, peaches sold this year from 40 to 55 cents per fifth basket; grapes, 25 cents. During the hot weather thousands of bushels of peaches in bushels and half bushels rotted. They should all be shipped in fifth baskets. If you can not organize for co-operation, strike out for yourself.

This is a day and age of competition and specialty, and requires special fitness for a successful outcome.

Mr. A. Hamilton of Ganges: My impression is that we can control transportation. We can build a boat for what we pay in a single season for freight. I think if the whole shore had dumped their peaches in Chicago this season we would not have had the prices we received, which on the whole were satisfactory.

Mr. D. W. Wiley of Douglas: It is said nothing succeeds like success. We have talked this matter over, with no satisfactory results, because we are not united. We in past years have paid too much for freights. I understand that they have shipped fifth baskets of grapes from New York state to Chicago for two cents, while it is to us five cents. I have shipped to outside places but have not made a success of it. These places demand first-class fruit and no one has yet been able to make his whole crop of that quality. In Chicago and Milwaukee they can handle our seconds. I think, however, if we could unite we could handle our own fruits or establish a house in Chicago. We have done well, but not as well as we ought. The commission houses in Chicago have unusual advantages in knowing the best markets, but by the time our fruits arrive at points beyond Chicago, they have filled them with fruit and the prices fall.

Mr. J. H. Crane of Fennville: I have been requested to give a résumé of the Fennville association, and present some facts to this meeting. They claimed in Chicago that the mode of handling the fruit by American express was quite unsatisfactory, the fruit being late in going on the market. When I came home we talked the matter over, and some twenty of us, in 1889, agreed to unite and form an association. We organized, appointed a loading and unloading agent to look after the shipments. After some correspondence the general manager of the railway, Mr. Mulliken, decided to still let the express company handle the fruit; but as there was no fruit last year it did not matter. This year the executive committee held meetings with the management of the road, which had then changed, and they agreed to guarantee a fair rate if the people would support the railway in preference to boats; but up to the day of shipment they would not give us rates. Finally they agreed to bill at 56 cents per hundred pounds in full cars and 29 cents for cars not full, or $52 per car. The loading and unloading was successfully performed, but the accommodations were not so good as they should have been. A life membership of 50 cents and a tax of 50 cents per car was expected to sustain expenses. We paid $2.50 for loading and $5 for unloading. Three hundred and ninety-eight cars were shipped from Fennville. The total charge for freight was $21,131.49, an average of $53 on each car of peaches shipped from Fennville; while for a car of apples they charge us only $28. Why, we can not understand. This made a rate of 3 to $3\frac{1}{2}$ cents per fifth basket. Shortages amounted to $57 and the sale of unmarked packages $61. Perhaps $3\frac{1}{4}$ cents per fifth basket would meet all demands. We have now $250 in the treasury of the association and may be said to be successful.

Mr. Wiley: The first rate offered by the railway was five cents, which was then well understood to be an arrangement between the boats and railway; and when the fruitgrowers obtained outside boats which came here and agreed to take fruit at a less rate, then this combination was broken and we got lower rates from the railway.

Mr. Gardiner on the subject of transportation said: We have two modes, by land and by water; and they get our fruits to market in the best manner. We have had cheaper rates on both, this year, than ever before. I have shipped by both means, and we are under obligations to both combinations, one for obtainining rates by cars and the other by boats. By the obstructions in the water I think the fruitgrowers lost $5,000 this year. The old line of owners, who said they could not live at less than a five-cent rate, when the opposition boats came in reduced the rate to $3\frac{1}{2}$ cents and still they lived. With only two exceptions, my fruit sent by the railroad was received in Chicago by 7 o'clock, and one of those was an accident. I had three shipments of peaches on the pier at one time, and lost on one shipment, during a storm, by damage, one fourth of the fruit. But there is often fault in the packing as well as the shipping. Some of the lower layers would make a pig squeal. I do not think the packers dishonest. I call it lack of judgment. Some of the fruit on the tree ripens before the rest. Pick that first, pack it carefully, go over the tree several times if necessary.

Continuing discussion of transportation, in the afternoon, Mr. Pearce said: We at Grand Rapids took up the question of transportation about the same time you did here, but dropped it for want of fruit. This year we reorganized and looked up the commission men from Dunn's Reports, and looked up their location, etc., and compiled these; so when we went to

them as an organization they would listen to us; and I think we must organize for best effects; there is a power in united action.

C. L. WHITNEY: This theme has been gone over very fully, but there are but two stages in fruit matters: first, to get it; then, to dispose of it. When the fruit is well grown the work is half done. The question of disposal then comes. The matter is then in the hands of two parties. ' The question of bad handling is sometimes called lack of judgment, but we call it dishonesty. This matter of gathering in the right condition is the first requisite, then sorting sizes, averaging sizes, color, and quality, and cooling the fruit—these are all important points; for heating in transporting often happens, and spoils the fruit; be prepared for all conditions of fruit and market by cooling-houses, with ice gathered in its season. Then, the package itself should be neat and appropriate—the better the package the better will sell the contents; good, spring, covered wagons, good enough to ride in, are none too good for fruit for market, and in such conveyances it does not become heated by the sun. Time is money to fruitgrowers, and they should have good smooth roads to get their fruit to market quickly. Organization should be created not only to get better rates, but to let people know that we have something to sell.

R. MORRILL of Benton Harbor: My experience is that lack of confidence is the greatest drawback to organization among fruitgrowers. You must have a fund and a good business management, to succeed, and I find that individuals succeed by personal effort in opening new markets.

Mr. MONROE: You have stated your experience in the direction of organization, and I have listened with great interest, for we need all the experience we can get on this head. We have made special efforts in our vicinity, in the preparation of the fruit for shipment, and we hear much less about "snide" packages; and some California peaches, I learn, are repacked and sold for Michigan peaches. While we we did not have such a choice of routes, we were interested in getting good boats; and, as has been remarked here, the rate is of less consequence to us than is the getting of good service; and the experiences related here today I think we will be glad to make use of hereafter.

Mr. E. HUTCHINS: I think it has been brought out here today, that there are two points that are of the utmost consequence to us. One is growing the fruit and another the marketing of it; and shall we not gain more by giving our attention to growing fruit than we shall by looking after the marketing? We can not all make good commission men, and it is doubtful if we can combine both with satisfactory results.

"Canning, drying, and other methods of disposing of surplus," was next considered.

Mr. C. SHEFFER of Casco: I think we would do well to dry seconds, or even feed them to the hogs (for they like peaches) to take them out of the market. Now, if California people can pay $9 per cord for wood with which to dry peaches, and then ship them across the country, I think then, with unlimited wood, we could dry them and keep them off the market. Pare those that can be pared. There are machines that will pare twenty bushels per day. About seven or eight pounds of dried peaches can be made from one bushel of fresh.

I certainly think that seconds are valuable for drying, and perhaps by better thinning we would have less of the second quality, but by drying we should remove a considerable portion of this class of fruit. Flooding the market with poor fruit injures the price of good.

Mr. HUTCHINS: Mrs. HUTCHINS canned and put up jelly and sent it to the commission men, and a demand for it was created; thoroughly ripe peaches may be pared by putting into scalding water, when the skin comes off readily.

Mr. MORRILL: I think if the farmers would can or dry their seconds it would remove them from the market: yet Mr. GODFREY bought peaches at 35 cents up here and put up 3,000 cans and he found a slight loss and he will can no more.

Mr. W. A. SMITH of Benton Harbor: I saw those peaches, and if he lost many he ought to have lost them all. They were put in cold storage and they were not fit to feed the hogs. If you wish to can peaches, you must can the very best, and this will pay. California ships her best. They were sold at Benton Harbor right under our noses, and while good to look at they were not good to a man who knows what a peach is. There are thousands in Chicago who can not purchase the best peaches, and they want our second-clsss fruit and they should have it.

Mr. LEWIS: I think we should dry peaches green and pull them off the tree as long as our consciences will permit.

Mr. W. A. TAYLOR: The Olden Fruit Co. of Olden, Mo., have 900 acres of fruit. The conditions are such that it pays them to can their seconds, and they get 50 cents per bushel at the train, and they make it pay. The canneries of the east began to can yellows peaches but it broke the market; but when the later and better fruit came in they got better prices.

Mr. MORRILL: The Olden Co. are a little better located than we are, and grow remarkably good fruit. They are thorough business men and they use largely their own fruit. They sell in the west and the fruit is better than our seconds. All those old farmers out there have dryers for their fruit.

Mr. W. A. TAYLOR: I have a few specimens of the date from Fresno, Cal., where it is hopeful the date can be successfully cultivated; also specimens of pecans which are one half larger than the common sort.

A paper by Mr. MORRILL, "Is it desirable for the general fruitgrower to raise small fruit?" was read, as follows:

I do not feel that it is within my province to say what kinds of fruit, if any, it is desirable for any man to grow, and hope my paper will not be construed as advice but rather as an attempt to point out the conditions under which it may be profitable to grow berries; also the conditions under which the venture would be a doubtful one.

The topic suggests that it is intended to apply to men who are already engaged in growing tree fruits, and the first question for such men to consider is, whether they can give both crops proper attention at the proper time or not. If they can, that question is settled; if they can not, then let it alone. The next point to be settled is the adaptability of your soil to the crops which you intend to grow. You may have a good strawberry soil. If so, it is most likely to be good for raspberries and gooseberries, but may not be good for blackberries or currants; but there are soils which are well adapted to each and all, including grapes as well. This can only be determined by trial.

If the question of soils proves satisfactory, you can then settle the most important questions of all by a little investigation in another direction—that is, market and transportation. If you are so situated that you have a good market within four or five miles, you are fortunate, as you will not be at the mercy of transportation companies or commission men. There are numerous cities and villages in this state that are very poorly supplied with fresh fruit, some of them not at all, and in such a locality there is always room for some enterprising man to plant a moderate acreage of berries and make the business profitable, as fresh, home-grown berries, neatly put up, will always be taken in preference to stale, shipped-in stock, and at better prices. If, on the other

hand, your market is to be the large cities, you will need to look carefully after the matter of trasportation. If you are where you can get good steamboat service at a price not to exceed thirty cents per bushel on boats running to Chicago or Milwaukee, leaving every evening, and arriving at the market very early in the morning, you are all right on transportation; but you can not afford to pay any higher rates, as you come directly in competition with other points from which they are laid down in these markets at a cost of eight to ten cents per bushel, and even at that price some growers think they have a hard row to hoe. If you have to use railway transportation, do not expect to be able to use freight, with any satisfaction, for distances of more than 50 to 100 miles, and even for that distance it is very poor service. The express companies furnish much better service, but their rates are exorbitant in this state; but the express method has the advantage of rapid transit and free delivery, while railway or steamboat service leaves a cartage charge to be paid in addition to the freight.

The above conditions apply to the small shipper, but the man who grows in large enough quantity can use refrigerator cars which, properly managed, will carry berries a thousand miles or more in good order, but can only be used to advantage in shipping to large markets, and usually from southern points to northern cities. Still, the conditions are now such that these cars can be used along the shore of western Michigan, not by individuals perhaps, but by associations of growers properly combined for that purpose. Such combinations are badly needed now to assist the small grower in holding a place in the market.

A few words about growing berries may not be out out of place here, as nothing has been said, so far, upon which the prospective berry-grower can base any calculation as to whether he can make the business pay or not. Commencing with the strawberry, the calculation would stand about as follows: Under ordinary conditions, on the basis of allowing a plantation to occupy the ground three years, which is as long as is wise or profitable, these are the expenses:

First year, 5,000 plants @ $2.50	$12 50
Preparing land, planting, cultivation, etc.	18 00
Interest on land and investments 8 per cent	10 40
Second year, interest on land and labor	20 00
Third year, interest	13 00
Total for three years	$73 90

If this amount has been judiciously expended, it will be found sufficient to give the acre good, clean culture, but if culture is neglected the estimate may not be sufficient. In computing interest on the land, I have given it a value of $100 per acre, which would provide for some choice land in a fair state of fertility. Such being the case, it should not yield less than seventy-five bushels of berries the second year, and sixty the third year, or a total production of 135 bushels for three years' use of the land. This would make the fruit cost about $1\frac{3}{4}$ cents per quart on the vines, to which add $1\frac{1}{2}$ cents for picking and 1 cent for package, or a total cost of $4\frac{1}{4}$ cents ready for sale in a new, clean package. I would consider the above yield very low, and under favorable circumstances would expect at least double the amount; and I have seen three times as much produced, in which case the cost, ready for market, would be reduced to 3 or $3\frac{1}{2}$ cents. On the whole, any man who can get 5 cents or more per quart for strawberries, including package, can make a little money growing them.

As for the other kinds of berry, I have been very much surprised, many times, how uniform the cost of producing a bushel of berries has proved in my experience, some kinds being more expensive in some respects than others, but invariably cheaper in some other respect, the average cost of producing a quart during the period of usefulness of any kind ranging from $3\frac{1}{2}$ to 5 cents. So I have always considered that any berry that left me 5 cents or more per quart, including box, was profitable to grow.

From the above statements it will be perfectly safe to draw your own conclusions as to whether it is desirable for you to grow small fruits or not.

The next topic considered was "Does it pay to use commercial fertilizers in fruitgrowing?"

Mr. J. Taylor: This is one of the questions concerning which a series of years is required to give accurate results. Nitrate of soda produces great effect on vegetables, but the results on trees was not so well developed, with a single test. Until you have tried them for four or five years in succession you can not form a correct estimate. I can not tell whether it has

a favorable effect on curl-leaf. Nitrate on strawberries I found beneficial when there is potash; when not, you must use ashes with it.

H. CHATFIELD. I got some nitrate of soda to experiment with on curl-leaf. I sowed it late in the season and thought it had a slightly beneficial effect. I also used it on strawberries and currants but could see no such result. I think we must fall back on barnyard manure.

Mr. J. H. CRANE: Mr. HALE wrote me that muriate of potash would cure yellows, and I said: "You can not make people around here believe this." I tried it and found no beneficial result.

Mr. MORRILL: "Commercial fertilizers" has a very extensive meaning. Nearly all fertilizers come under this head, including ashes, and there are many combinations. The results depend usually upon how much of the different ingredients are in the soil. Some companies furnish complete fertilizers, and there are many of these, and a trial might show in one case a benefit and in another a loss, and in another no result. Unless it makes a proper combination it is of no use and should be used supplementary to the use of barnyard manure.

A paper was read by Mr. J. F. TAYLOR, on yellows. In substance he said: The presentation of this subject has become old and trite. For twenty years this disease has been studied and remedies sought, yet the secret of the matter has not been found nor the cause of the germs of this scourge. Three methods have been practiced. First, that of letting it alone, by those who have little interest in this subject; second, the medical one—some have had to take their own medicine with damaging results—for full description see Michigan Horticultural society reports; and after twenty years, only those who have applied the axe have produced good results—this is the axe method, and so far as we know is the only way to remove this infectious disease. Cut and burn as soon as possible.

A question was asked, "Do bees spread yellows?"

Mr. W. A. TAYLOR: There has nothing come under my observation to show that bees do spread yellows. Prof. SMITH says that he has no evidence that bees spread the disease or that inoculation in the blossoms will spread it: but by budding he has proven that yellows can be produced and that it will remain dormant for two years in the bud.

Mr. PEARCE: I have known of cases where yellows existed with hundreds of hives of bees and the disease has spread but slowly; and while I do not know, yet I hardly think, a tree could escape if the bees spread it.

Mr. CHATFIELD: We sometimes find one peach on a tree has yellows, and it seems as though the bees might have done it.

It was stated that drawing the branches of trees infected with yellows through the orchard would infect the orchard. Mr. TAYLOR said in regard to this, that there might be danger in the contact of the trees ; but he had bees in his orchard and he did not believe that the bees communicated the disease. THOMAS BIXBY at South Haven told me that he drew a tree infected with yellows and infected seventeen rows of trees: and in plowing, he thought, the horses carried the infection from one tree to another.

Mr. LANNIN : I have seen two trees interlocked : and while one rotted down with yellows the other was not affected.

Mr. W. A. BROWN of Benton Harbor : I do not see how any one can doubt that yellows is contagious. Commencing at Benton Harbor, it spread north. We pursued the let-alone policy and doctored the trees and lost them. We are not afraid of it now, and while we have fine orchards we do not have yellows : and still we know no more about it than we did fifteen years ago. There is no cure for it except eradication.

Mr. HAMILTON: I have been asked, "Have the peach orchards of Allegan county been exterminated by yellows?" I replied, by no means. We are still doing business and the trees destroyed are more than replaced by others. The impression has gone out that Allegan county has gone out of the business. but I wish to say that western Allegan has shipped this year not less than 4,000,000 packages. so that we are still in the business and growing more peaches than any other portion of "the belt," and the returns are near $1,000,000; and many men have told me that they have sold their crops for more than they could have sold their farms last year. Yellows is not increasing.

Mr. LANNIN: I believe that Allegan county sent more peaches to market than all the counties north and south of it.

A paper was read by Mr. W. A. BROWN of Benton Harbor, on "History of the Strawberry."

Invitations for the June meeting were extended by JUDGE RUSSELL of Hart, in behalf of the citizens of Hart and the Oceana Horticultural society, and from C. L WHITNEY, in behalf of the society of Muskegon county. The former was accepted.

This question was asked: Supposing a man has a farm of 40 acres, 38 devoted to fruit, what should he do?

W. A. SMITH: If the land needed fertility. I should seed to clover among young trees. I would cultivate. say. five feet each side of the tree and leave the clover in the center for three or four years, then plow. This will not last always. Use ashes, barnyard manure (all you can get), lime dust. Commercial fertilizers are rather expensive. but if the trees are bearing use of them will pay. Putting clay on sand for pears is good; and you can not raise pears without clay.

Mr. SHEFFER: I have tried ashes for peach trees but never found any advantage. A neighbor has bought ashes by the carload, but I could never see any advantage from it. I would sow rye with clover, and if I could get muck I would compost.

Mr. HOUK: I have had some experience in raising the fertility of soil, raising 120 bushels of corn to the acre. I put on ten loads of ashes, two barrels of hen manure, and one barrel of lime to the acre. If a man fertilizes with ashes he must put something else with it. Two crops of clover plowed under go a great way in this direction. Some of our land does not need manure. You should make the soil good before setting out trees.

Mr. HUTCHINS: When we speak of fertilizers, we must recollect that they are but partial fertilizers. You can not make soap from grease alone, and you must supply the missing one or more of the three elements that the plants need—potash, sulphates, and nitrates. Ashes is a valuable fertilizer, and if you see no good result. then your soil certainly needs some other elements.

Mr. WADSWORTH: I have made some efforts to use muck on heavy clay and I found it a grand good thing.

Mr. MORRILL: I have found that on sand, ashes are valuable, and it may be so on heavy clay. I can get a good catch of clover by following ashes with clover.

Mr. WHITNEY: I do not believe that we can throw away one pound of manure. We need it all. They used to say in Illinois that they did not need manure. Now they are buying. But to answer the question, I think that for 38 acres of fruit, one should reserve ten acres at least to raise crops for manure, and practice saving every pound of fertilizer that could be produced.

On the topic, "Exhibit of West Michigan fruit at the World's Fair," said

Mr. MONROE: I think we can appreciate that this is one of the most important events in the lives of all present, and especially to the people of Michigan. There are many advantages to us. One idea of the exposition is teaching by object lessons. Cities, countries, and provinces will be presented in miniature. In making a display of fruits we should show also the trees themselves. If in California we would not care to see the oranges only, but the trees as well; and we should have each class looking after their own products. I have been greatly puzzled as to how to present the matter to the state commission so that we may obtain some of the state appropriation for a proper exhibit. Manufacturers can sell their products and advertise them in a profitable manner; but our fruits are on a different basis. We wish to show the tree as well as the fruit. The tree will be the attraction more than the fruit, which can be seen anywhere. But who can contribute the tree, one of the best of his orchard, to be thrown away when the fair is over, as well as his time?

Mr. MORRILL: I think this is the proper time for competent men to meet the commission. After the cost of the building comes out of the fund, there will be left but a sum of say $65,000 for all the industries of the state. We should have a specific sum and then we would know just how much we can do. A competent man must be there to take care of and renew the fruit. For instance, Berrien county can start the Alexanders and Oceana county finish them. The market value of the product of fruit in this state equals any other market product of the state. Ten per cent. of the appropriation would be too small.

Mr. LANNIN: I had thought of taking a part. I have prepared twelve pear trees, which I propose to put into boxes and by forcing have them ready to produce fruit at the Fair. These must be boxed for at least one year, and protected and cared for. Then there must be competent care for them. I should make nothing from the exhibit. To make a practical exhibit of all fruits would require expense, care, and ability.

Mr. MORRILL moved that Mr. PEARCE be sent as a delegate to meet the World's Fair commission at Grand Rapids in January. Mr. PHILLIPS moved to add Mr. WHITNEY to the delegation. Both gentlemen were chosen.

Mr. MONROE moved that,

WHEREAS, The horticultural interests of our state, being widely scattered and mainly carried on by people of limited means; and whereas little or no pecuniary benefit can be expected to even partially compensate for time and money spent; therefore

Resolved, That the West Michigan Fruitgrowers' society deems it important that the state commission set aside a specific sum to at least pay freight, properly put up, label, renew, and care for the exhibits.

This was adopted.

The committee on resolutions presented a report thanking each and all of those who had in any way contributed to the success of the meeting.

The report of the committee on fruits showed exhibits as follows, of apples: L. L. LANCE of Ganges, 11 varieties and 1 plate of quinces: A. B. HOUK of Ludington, 13; R. V. WADSWORTH of Ganges, 2 baskets: J. MILLER, 5 baskets; JAS. GARDINER of Ganges, 5 baskets; HENRY PLUMMER, 4 plates and 2 baskets; Mrs. L. H. HOWARD, 3 plates of apples, 2 cans dried fruit; W. B. STETSON, 1 plate each of apples and quinces; LEVI LOOMIS of Ganges, 2 varieties of apple. Mr. GARDINER also showed 3 plates of peaches of the Smock and another variety.

The annual election resulted as follows:

President—Joseph Lannin of South Haven.

Vice-Presidents—F. J. Russell of Hart, A. Hamilton of Ganges, G. H. LaFleur of Allegan, A. C. Glidden of Paw Paw, W. A. Brown of Benton Harbor.

Secretary—C. L. Whitney of Muskegon.

Treasurer—W. A. Smith of Benton Harbor.

Executive Committee—J. B. Houk of Ludington, A. Adams of Shelby, Walter Phillips of Grand Haven, D. W. Wiley of Douglas, and J. A. Pearce of Grand Rapids.

GRAND RIVER VALLEY HORTICULTURAL SOCIETY.

SECRETARY'S ANNUAL REPORT.

Seventeen years ago, a few men prominent in horticulture met in Fuller's bank for the purpose of organizing a horticultural society. It was decided to organize under the above name, and it was declared by those present to be a necessity. Like all good things its progress was at first slow, but, as all things seem to be rapidly marching to a higher grade, this society naturally fell into line, and today it has become of importance, not only to its immediate county, but to the whole country. Its now honored president was just coming into notice as a college graduate of considerable prominence, and the present secretary, just arrived from Britain's shores, 17 years old, much preferred a ramble in the woods of a new land or a rough-and-tumble with his "Yankee" cousins than to continue in the school studies begun in England.

The present year shows a gain of thirty per cent. in actual working members, over any previous year, and as there is some hope that Grand Rapids will have a chrysanthemum show next November, it is thought that more of the florists will feel it their duty to join. Market gardeners should also take hold of this society, and they would find the fruit men not only willing to listen to the progress made in this branch of horticulture, but to adopt a more general system of cropping.

The society this year has no debt to pay, but has a balance of $56.40 in the treasury, not much to be sure, but it is better than being in arrears.

In 1888 the ladies were admitted and picnic meetings adopted, and today the charms of the ladies and their lunch baskets have much influence in leading the men to long for the fourth Tuesday in the month.

On the fourth Tuesday in January the executive committee of the society met in the parlors of the Grand Rapids Savings bank and arranged the following schedule of meetings and topics for the ensuing year:

February Meeting—Paris Grange hall, topics: "Varieties of fruits and vegetables to plant;" "School gardens."

March—City hall: "Insects and insecticides;" "Fungi and fungicides."

April—At the residence of Henry Smith: "Possibilities of horticulture under glass;" "The children's garden."

May—At Grandville: "How to manage a forty-acre farm and maintain from it a prosperous family;" "Fun in farming."

June—Herrington Grange hall: "Strawberries;" "Excessive praise of new varieties of fruit."

July—At the residence of Sluman L. Bailey, near Soldiers' Home: "Raspberries;" "Rural taste and its cultivation."

August—Lowell: "The ins and outs of peach-growing;" "Attractive highways and how to secure them."

September—At the residence of W. K. Munson: "Grapes and grape products."
October—Sparta: "Culture of apples and pears;" "Horticulture in the schools."
November—Harmony Grange hall: "Experience of the season with varieties under cultivation."
December—Residence of Charles W. Garfield: "Our experimental stations;" "Speculative horticulture."

Owing to a continual downpour of rain on the fourth Tuesday in February, only those members in the immediate neighborhood of the Paris grange hall were able to be in attendance, and despite the fact that neither president, vice-president, nor secretary was there, the plucky few very ably discussed the topics, which were, "Varieties of fruits and vegetables to plant," and "School gardens." The meeting was called to order by Mrs. I. D. Davis, with Mr. E. H. Stiles acting as scribe. The following day the great majority of the members were somewhat startled to find in the published report that no officers were present save one member of the executive board—a condition not without precedent, however, as the minutes of the June meeting at Fuller's hall, in 1874, was the occasion of a similar state of affairs.

A table hard by the chairman was conspicuous for the many different styles and sizes of squashes in such excellent condition that inquiry as to who was responsible for the display brought Sluman S. Bailey to his feet, who apologized for not bringing larger ones; but he left in a hurry and came with his carriage. Mr. Bailey said the largest ones were the Pike's Peak variety. It was an excellent keeper and as toothsome as the Hubbard. The bugs did not like tobacco water, but it would not entirely keep them away. Squashes would keep better if gathered early. A warm, dry air was necessary to keep them thoroughly preserved from rot.

In the discussion of desirable varieties of apple, the Baldwin seemed to have secured an undue amount of praise.

Paris green as an insecticide was considered better than London purple.

After going through the list of desirable varieties of potato, the following were the chosen ones: Beauty of Hebron, White Elephant, Empire State, and Early Ohio.

The adornment of school grounds was still a perplexing question, so likely are children to either destroy any attempt at adornment or to take no interest. Mrs. Emmons thought that the best way to insure safety to trees was to let the children plant them themselves, under able supervision.

The following resolution was passed: "That the members of the Grand River Valley Horticultural society, assembled at their February meeting, extend their sympathies to all absent members for having missed a good meeting."

The March meeting was duly called to order on the fourth Tuesday, at the City hall, by Vice-President Pearce. Mr. Garfield was in attendance at a specially called meeting at Lansing, but returned at noon and conducted the meeting in its afternoon session. The very important topics, "Insects and insecticides," and "Fungi and fungicides," drew out a large gathering. Over one hundred were present when Mr. Garfield tapped for order, who after getting a little insight into the work done in the morning, called for local fruit prospects. The general testimony showed that growers and carriers would have something out of the ordinary run of things to handle the prospective fruit crop of 1891, especially peaches. Mr. Garfield said the very latest estimate he could secure for Allegan county alone was 1,000,000 bushels.

The programme of topics of the year was read, calendars distributed, and much interest was shown by the gathering.

Mr. GARFIELD was asked to urge upon the society the importance of the bill introduced in the legislature by Senator PORTER, being a bill to protect bees from poison through the spraying or otherwise treating of fruit or other trees, shrubs, vines, or plants, with London purple, Paris green, white arsenic, or other virulent poisons, or to scatter upon such trees any of the named poisons, while such trees, vines, or shrubs are in blossom, or while bees on such trees, vines, or shrubs are in quest of nectar or pollen.

The reading of the bill was well received, and Vice-President PEARCE made an earnest plea for its support. It should, he said, meet with the unanimous support of this society. Other members spoke in favor of the bill, and ASA W. SLAYTON would hold up both hands for its adoption. Mr. BAILEY said it was not severe enough. ALBERT JACKSON of Lowell thought the fine in the first offense should not be more than $5 nor less than $1, and in the second not more than $50 or less than $25. He offered this as an amendment, but it was lost. All sides of the bill were gone over, and some said we did not need it at all; but the prevailing opinion was in favor of the bill. Mr. GARFIELD remarked: "It is framed for those who are ignorant of the harm they might do. The idea was to properly bring before the notice of every one when it was the right time to spray," and rather than see the bill become a law he favored a measure of first trying what money could do in disseminating a general knowledge of spraying throughout the state. A vote on the bill resulted as follows: yeas 34, nays 32.

Spraying trees occupied the remainder of the session. Paris green for apples, cold water for the plum, copper solution for grapes. Professor COOK advised planting here and there a plum tree in a peach orchard. Here the curculio would gather and be more easily destroyed.

The fourth Tuesday in April was a delightful day—cool and sunny—and a large gathering greeted Mr. SMITH and Mrs. SMITH and shared in the hospitalities extended by these progressive florists and fruitgrowers.

At 11 o'clock, President GARFIELD called the meeting to order, and, after the reading the minutes of the previous meeting, entertained the company with several items of interest he has a habit of collecting for every meeting.

After the usual recess for refreshments, and a stroll through the greenhouses, the members arranged themselves for the afternoon session, but so large was the crowd, that every chair in the house was occupied, besides those procured for the occasion, and when the secretary was called upon to read his paper, "Possibilities of horticulture under glass," he was horrified to see the very stairs black with people and numerous heads peering over the banisters from the landing above. The effect of light or darkness upon plants was thoroughly discussed.

S. S. BAILEY was present with squashes in a perfect state of preservation, and attributed the cause to a dry, warm room for a storehouse. Attention was called to the great lawn fertilizer, nitrate of soda. Applied early, it was one of the cheapest and best fertilizers; but it does not contain potash or phosphoric acid, and its continual use would retard plants in coming to maturity.

Mr. WILDE announced that he had successfully killed the curculio with corrosive sublimate.

It was moved that the second topic, "The children's garden," be set aside and the time used in looking through the greenhouses.

The regular monthly meeting of the society for May was held at Grandville, in the home of the secretary. President GARFIELD called the meeting to order.

After the usual routine business was transacted, reports were taken on the fruit prospects. May had made itself famous for three successive hard frosts which almost totally destroyed the strawberry crop on the low lands and created no small amount of concern for the peach crop. The cherry crop was reported ruined; and it was thought currants had shared the same fate. Apples were reported to be much injured.

CHARLES A. FRENCH exhibited his milk-tester and explained its use, giving tests with four samples of milk, to ascertain the percentage of butter fat in the milk of different cows. The milk is well shaken, and half a gill placed in a gill pipette; then an equal bulk of sulphuric acid is added, which neutralizes all the milk except the fat. The pipettes have a six-inch stem on which is marked the scale. The four pipettes of glass are placed in a centrifugal machine, bulbs outward, stems leaning to the center, and revolved six minutes, to completely mix the milk and acid. The stems of the pipettes are marked off into one-hundredths of the capacity of one half the bulb. Good Jersey milk will give $7\frac{1}{2}$ or 8 per cent. Four and a half per cent. of butter fat should give about four and a half pounds of butter to 100 pounds of milk. The milk being neutralized, hot water is added, to separate the fat from the acid. Turned another minute the pipettes show a black acid in the bulb, an inch or more of the stem showing water, and above all the yellow fat, showing from six and a half per cent. for the grade cow, down to two and eight tenths, and one tenth of one per cent. for the skimmed samples.

Mr. FRENCH read a paper before the society, "How to manage a forty-acre farm and maintain from it a prosperous family."

The June meeting was held on the regular day, in Herrington, and called to order by President GARFIELD, who gave a resume of the recent meeting of the fruitgrowers. They had decided to issue a circular giving the amount and quality of fruit in the hands of every grower in the county. It will show that there is some horticulture in the country outside of California. He hoped there would be a spirit of rivalry engendered by the two fairs which would result in the success of both.

The display of strawberries was one of the finest ever made, THOMAS WILDE being the principal exhibitor, and he gave preference to the Cumberland variety for a near market, and the Crawford for shipping qualities. The Bubach, Climax, Parker Earle, and other new varieties were discussed freely and tested numerously. The Talmage band enlivened the day with selections very well rendered.

E. C. PHLLIPS exhibited cherries, Early Richmond, May Duke, Knight's Early Black, and Governor Wood. He claimed cherries paid better than strawberries.

ASA W. SLAYTON read a paper, "Fun on the farm." It was a well written treatise, full of clean-cut humor, and proved an attractive feature of the meeting.

Resolutions of thanks were extended to the friends in Herrington and to those whose grand display of fruit helped make the day a success.

The July meeting was largely attended and the display of raspberries was grand. Mr. and Mrs. S. S. BAILEY were as entertaining as ever. Mr.

and Mrs. HERMAN BAILEY welcomed the members, and provision had been made to take visitors to and from the Soldiers' Home, either in caryalls or on the boat.

President GARFIELD called the meeting to order, and after the minutes of the previous meeting were read, gave a very interesting account of the things he had noticed in Chicago. Again calling attention to the two coming fairs, he said he hoped every member and every horticulturist would say a good word for whichever fair he intended to patronize, and say nothing to hinder the progress of either. "We have nothing to do," he said, "with the strife between the executive department of either fair; it is our duty to do all we can for our fair, whichever one that may be, and use both for the purpose they are intended to serve, which is the education gained from the comparison of the exhibits which a spirit of rivalry and competition brings out. Let us advertise to the world that Kent county produces good fruit and much of it, and we may safely say we furnish the best market in the country for large quantities of it.

E. C. PHILLIPS exhibited Alexander peaches, Red Astrachan apples, and Cuthbert raspberries. Many other worthy exhibits were noticed.

A good word was said for the Schaffer raspberry. It was regretted that it took so much recommendation to sell it. Mr. WOODWARD preferred the Cuthbert, for the reason that it was the best berry there is, provided the right situation was given it, and that should be a heavy soil.

Black raspberries came in for a good share of attention, but of all the varieties the old Turner was the best for table use. Though perhaps too small for market, the flavor was superb. The second topic, "Rural taste and its cultivation," was opened by ASA W. SLAYTON who said his ideal of that was "Raspberries and cream," but when he looked over the gathering he was sure that kind of taste needed no introduction that day. After a few such jovial introductory remarks, the venerable scholar settled down to a very interesting talk that seemed to open to his hearers an entirely different life that might be enjoyed by many if they were so inclined. "A home," he said, should be embellished outside with plenty of fruits, shrubs, and flowers, and provided with a vegetable garden with a great variety of products. There were other ways for enjoyment about a home, aside from a fine house and fine horses. The interior is also an index to our individnal tastes, but in many homes there is a lack of beautifying owing to the undeveloped taste for such things.

WARREN WILLARD and Mr. C. A. FRENCH also contributed valuable suggestions for home comforts.

Rev. JOHN SAILOR closed the meeting by making an urgent appeal for attractive homes. They may be the means of retaining some of our most progressive boys on the farm, so much needed at this time.

The August meeting, at Lowell, was a success. The Lowellites had prepared everything for a crowd from lower down in the valley, and they were not disappointed. Probably the largest delegation in the history of the society went to Lowell to help in the discussion and share the benefits of that meeting. The morning was cool, a bracing west wind was blowing, and our Lowell friends, fearful that the beautiful island they had prepared for the entertainment of the visitors would prove too cool a resort, the opera house was opened to the society and the morning session held there.

At twelve o'clock every one went to the island. The weather was now delightful. Hastily constructed extra seats were quickly gotten into

shape, and here and there on that lovely spot the merry party sat down in twos, threes, and dozens to their lunch.

The first important business done in the forenoon was a discussion of freight rates. JOSEPH A. PEARCE thought bushel baskets should be classed as low as crates. They do not tip over, are tightly covered, and are just as easy to handle. Mr. JACKSON doubted if anything could be done with the railway classification committee this year. A committee, consisting of Messrs. JACKSON, PEARCE, and BAILEY, was appointed to look up freight rates and report later. The following resolution was presented and adopted:

To the Railway Classification Committee:

Resolved, By the Grand River Valley Horticultural society, that the fruit interests of Kent county demand that fruit shipped in covered bushel baskets be rated the same as fruit shipped in crates.

This meeting also made itself famous for its grand defense of the honey bee. The chairman was asked to bring the action of Mr PEARCE'S neighbors before the meeting, asking Mr. PEARCE to destroy his bees as they were ruining the peaches. The matter was thoroughly sifted and the conclusion arrived at that the bee is the friend of the horticulturist, inasmuch as his work of carrying pollen and fertilizing fruit was of more importance than any other one agency for that purpose. The drought had checked the supply of honey and moisture from flowers, and to any over ripe peaches the bees would flock in their endeavor to get a living.

A long table in front of the speaker's stand was loaded with samples of fruit brought by members. Among the exhibitors were NOAH P. and J. T. HUSTED, W. S. MOFFITT, ALBERT JACKSON, CHARLES WINKS, FENNINGS SONS AND CO., H. W. CAREY, C. C. WINEGAR, M. HUNTER, and MYRON KEYSON.

In the afternoon session W. N. COOK briefly alluded to the early days of the Grand River Valley Horticultural society. There were only a few members then, but they were in earnest, and today the society was of great importance. The Grand river valley was the cradle of fruit-raising. ALBERT JACKSON and NOAH P. HUSTED also made short speeches. The early Michigan peach originated at Lowell, on the old Husted place.

The topic, "Ins and outs of peach-growing," was opened by Rev. JOHN SAILOR, who not only thought peaches were of importance, but said the apple lands of the county exceeded those adapted to peach-growing. He was glad to notice the rapid progress of the fruit interests in the Grand river valley.

S. S. BAILEY and others continued in the same topic until lack of time suddenly brought any further remarks to a close, and the second topic, "Attractive highways and how to secure them," was postponed.

Mr. JACKSON offered the following resolution, which was unanimously adopted:

Resolved, That this society memorialize the State Horticultural society in regard to the peach known as Early Michigan, asking them to give it a name, and that the name Husted, that of its originator, be connected with the name.

President Garfield then read the following resolution, which was adopted:

The Grand River Valley Horticultural society, assembled in its August session of 1891, desires to express its hearty appreciation of the kind invitation given by the people of Lowell to meet in their village, and we hereby express our hearty thanks for the cordial reception and kind attention given us this day, and desire to have the fruit-growers of this locality meet with us and coöperate with us in our endeavors to disseminate useful information regarding progressive horticulture, and at the same time have enjoyable entertainment.

The September meeting was held on the first Tuesday of the month, at W. K. MUNSON'S. Vice-President PEARCE called the meeting to order, and, after the regular order of business was transacted, called attention to the work done by the fruitgrowers' association. The amount of peaches daily put upon the market was wonderful, being from 4,000 to 6,000 bushels, all going daily at a good price. Grand Rapids was truly the center of the fruit belt, and needed a regular market place worse than did any other place on the globe.

The peach yellows law was read. The present year had seen quite a spread of yellows. The greatest care should be taken, and infected fruit. it was thought, might be the means of contaminating other trees. The infected samples on exhibition were buried, and strong resolutions were made to crush out the disease.

After the usual luncheon and social half-hour, the party visited the vineyard. About ten acres of as healthy vines and as clean land as any one could wish to see—not a weed to spoil the effect, not a branch untied. All was in "apple pie order," with no signs of the long drought; but from forty to fifty tons of extra fine grapes were in sight. Mr. MUNSON practices the Kniffen system of pruning. A prominent feature of his plan was a cold-storage house without ice. A long pipe from a shady north valley brought in the cold air, and a high chimney in the center completed the circulation.

"Grapes and grape products" occupied the attention for the remainder of the session.

October 27, 1891, will be long remembered by the horticulturists around the city who dared drive the whole distance, thirteen miles, against a high, freezing, northwest wind, to the pretty village of Sparta. The arrivals from the south were the bluest-looking specimens of humanity imaginable. They reduced the temperature of the room so much that the janitor had to hustle. A group of ten of these half-frozen people huddled around the stove, but it was some hours before the last shiver had ceased to torment them.

About noon, President GARFIELD called the meeting order. He had recently returned from Washington, and he so much delighted his hearers with an account of his trip that a resolution was afterward offered by Vice President PEARCE, and passed, to have the president's notes hereafter made after dinner, when there were always more to hear.

The fruit exhibit, although not large, contained some fine specimens. A. Boss of Jamestown brought Smock peaches of immense size. F. C. JACOBS showed five varieties of apple, Hubbardston, Wagener, Dickenson, Rome Beauty, and Grimes' Golden.

In the afternoon, the topic, "Culture of apples and pears," brought out much valuable advice. After talking on this subject for nearly two hours, during which time the Ben Davis received a black eye, the following five varieties were recommended as the best apples: Northern Spy, Red Canada, Jonathan, Wagener, and Baldwin.

The second topic, "Lessons in marketing," was also of much interest, and the conclusion arrived at that Grand Rapids was a satisfactory market. It did not seem to make any difference how much was offered, there was always a chance to dispose of the fruit at paying prices.

The November meeting was held in Harmony Grange hall. It is not a very inviting building in outward appearance, but one of the heartiest of welcomes was given the occupants of the thirty-odd carriages that

appeared. The time before dinner was spent socially. At about one o'clock President GARFIELD called to order and S. E. ROGERS was made secretary *pro tem.* Mr. GARFIELD then chatted for awhile upon the subject of farmers' institutes. He stated that there were to be two big institutes added to the programme, the objects of which were the kindergarten work of farming. He called attention to the exhibits of fruits and flowers made by the several members present, which was entirely unnecessary, as the fragrance of the roses filled the room, the gorgeous colors of the chrysanthemums dazzled the eyes, and the pondrous proportions of the peaches, grapes, apples, and beets were a wonder for all.

A portion of the display was as follows:

SLUMAN S. BAILEY of Paris—Apples for nomenclature. They were picked from a bough of a Golden Russet tree, but looked more like Greenings than Golden Russets.

H. C. HOGADONE of Walker—Shorthorn carrots, Sugar and Blood beets, for which he wanted the opinion of those present on their respective value with grain for feeding to stock.

W. K. MUNSON—Niagara grapes kept in cold storage.

S. C. WOODMAN of Walker—A basket of Keiffer pears and a sample of excellent eating apples, which no one named, but were assuredly from a Maiden Blush stock.

ASA W. SLAYTON—Sweet potatoes of the Nansemond, Gen. Grant, and Dixie varieties.

HENRY SMITH—A grand display of roses, and Chinese, Japanese, and native chrysanthemums.

This display of products was made the basis of the remarks to be made, and the president first called upon H. C. HOGADONE of Walker. He explained the culture of sugar beets. He raised twenty-five bushels on the twentieth part of an acre. Cattle and hogs are very fond of them; he preferring them to the Mangel Wurzel or the Blood beet. He asked for information in regard to the feeding of these roots in comparison with corn.

Mr. WILSON of Walker thought both were necessary, and if both were fed the stock would not be cloyed on either. He thought about four bushels of beets were about equal to one bushel of ears of corn.

Mr. WILLARD of Alpine thought the value of root crops was overestimated. Because we can raise a large number of bushels of carrots, or turnips or beets, it does not follow that there is more nutriment for cattle, grown to the acre. Mr. WILLARD thought the proportion of nutriment was five bushels to one as compared with grain.

ASA W. SLAYTON being then called upon to speak about his sweet potatoes, read the following:

Fay's Prolific currant far excels my Red Dutch, White Dutch, and White Grape in health and productiveness. The last three varieties, formerly so good, seem to be dying out. My Turner raspberries are a failure for table or profit and have been dug up. The Snyder blackberry shows not a pint of gratitude for four years of care, and will be converted into useful ashes. Of grapes, Brighton and Vergennes are thrifty, productive, and good; Lady Washington, immense clusters, good; Jefferson, indifferent grower, small, skinny; Pocklington, tender as a gosling, are for sale. The Lemon peach, free, is an excellent late variety. The Pike's Peak squash is productive and of best quality. Hardly a dozen of the bad-odor squash bugs visited me this year. There was no wiping of eyes or rubbing of noses about it, either. The Egyptian Blood Turnip beet, when young, is good for the table; but when large, after you cut off the pithy crown and trim off the rooty bottom, there are but two slices left for consumption. Hungarian Honey watermelon is excellent in quality and thinnest of rind, red to one fourth inch of outside; but it is rather seedy and round as a cannon ball, and when you cut one and cut off two slices from each half you have only two bottoms left. Not so with the Gray Monarch, or White Icing, a long, cylindrical melon of best

quality, which you may cut and take off a dozen equal slices from each half and then put the two ends together and have a melon as large as the Hungarian. I have grown many of the White Icing so large they would not go into a bushel basket.

Gen. Grant sweet potato, vine a vigorous, compact grower, tubers unconditional spreaders, good, but hard to catch. Dixie, more rambling in vine, pink skin, good, one weighed thirty-six ounces.

For your benefit, not mine, perhaps, I would better tell you of one other species; or, better, an old species under a new dispensation, which I cultivated; or, rather, which cultivated me. I was fixing the fence at the further side of a ten-acre lot. He came clear there to see me. He was well dressed and wore a recognizing smile. The birds were trilling their softest notes. He carried a small roll of paper in his hand. The cows were biting industriously at the short grass. He approached confidingly. The skies were serene and all nature seemed at ease. "Good morning," said he, "a very pleasant day, and you have a pretty place here. I was not aware that you had so nice a place out here. I have a few clematis here that I procured for a lady on Union street, but she is gone from home and I thought I would offer them to you; that fine porch of yours needs a few clematis to set it off to advantage." By this time he had unrolled the paper and displayed three fresh-looking roots. "Where were they grown?" I asked. "At Rochester, New York," said he. "By what firm?" "By Williams & Co.; I am their general agent for this state." "It must be a new firm, then," said I, "for I have been acquainted there a long time and have not heard of them before. "O, yes, just started, doing a fine business, giving the old firms a hard push." "But is it not too late to set them? I have never set such plants so late as July." "O, no; it is just the time; they do better now; the roots are fresh, just received this morning; that long root is a purple clematis, that one a red, and that one a magnificent white." "Is the purple a Jackmanii?" I asked. "O, yes, and one of the finest clematis grown." Now, I have had that same Jackmanii covered with bloom from June to October, plants that a ten-dollar bill would not buy, and confess to a weakness for clematis; but of course he did not know that, so I assumed a look of indifference and asked the price. "They are worth much more," said he, "but I need the money today and you may have them for fifty cents." I knew that three good clematis would be cheap at a dollar. The bait was tempting. I bit. He modestly took the money and his departure, and has kept them both ever since.

I handled those roots gently; I set them carefully, shaded them tenderly, and watched them concernedly; and finally was rewarded by buds bursting up to the light of the outer world. Faith, aided by works and water, had triumphed.

What joy when the first leaf unfolded! But somehow it looked suspiciously unlike any clematis leaf I had ever seen. The next leaves were like unto the first, and the third plant played ditto.

Now a microscopic examination showed all three of the plants to ampelopsis quinquefolia, or the common five-fingered ivy, dozens of which I had been trying to kill out around my house for the past four years. When the truth broke upon my benighted brain it caused my head to swim and my heart to pit-a-pat in such a way that all that day it seemed to say: "O, what—a sin, to be ta—ken in, as slick—as a pin, by a game —so thin, and lose—your tin." And when the shades of night had fallen and the drapery of my couch was wrapped around my guileless form, and earth's despond had given place to dreamy bliss, floating far away I saw a white-winged messenger, one thumb beside his nose and fingers working mischievously, while faint voice in silvery tones brought back the soothing refrain: "'Twill now be told, in accents bold, to the shining fold, in the streets of gold, that you're getting old, and easily sold."

Was I spunky? Would you have been?

W. K. Munson then gave a description of the method of cold storage by means of which he kept his Niagara and other grapes in the excellent condition which he exhibited them. He thought the method was the best in use for keeping all kinds of fruit and vegetables, but he saw no particular profit in keeping grapes for winter, because the market is then dull and the price is not adequate to the trouble of keeping.

Henry Smith, who had a fine exhibit of chrysanthemums and roses, explained the culture and improvements made. He said he had one hundred varieties, each flower distinctly separate. He gave a sweeping invitation to all present to visit his greenhouse. It was conceded by all present that chrysanthemums were especially valuable for bouquets, as having such lasting qualities.

Mr. WOODMAN, upon being asked about new varieties of peach, mentioned Lewis, Crane's Yellow, (St. John) and Bronson, and he thought they would all do well and take the place of Crawfords and ultimately of all the leading varieties. Mr. WOODMAN thought Moore's Early was the best early grape, and two weeks earlier than the Worden. Mr. MUNSON thought it about fifteen minutes earlier and not nearly so productive. Mr. KIEFFER called attention to a new black grape which he said was three weeks ahead of the Worden. No one could give the variety a name. Mr. SLAYTON thought Moore's Early was the best tasting grape he ever put in his mouth. President GARFIELD and several others differed with him, and the venerable secretary of the West Michigan Farmers' club came to the conclusion that he must have been mistaken. Mr. MUNSON called attention to the practice of putting Niagara grapes on the market before they were ripe, and thus ruining the market. If they were allowed to ripen on the vines, they would, from their superior flavor, great bearing, and excellent keeping qualities, prove the most profitable grape grown.

President GARFIELD asked what varieties of sweet corn were the most desirable for market. HENRY SMITH named Early Minnesota, Crosby, Perry, and Stowell's Evergreen in the order named. Stowell's Evergreen is about going out of use because it does not yield enough, and the Crosby is fast taking its place.

The subject of squashes having been brought up, Mr. RICHARDSON, Mr. SMITH, and others thought the Pike's Peak squash fully equal to the Hubbard and much more productive.

President GARFIELD called attention to the fact that the past season was an exceptional one for the ripening of all kinds of fruit and vegetables, and it may be possible that the experiences of this year will be materially changed next year.

Mr. WILLARD advocated the raising of sweet corn as fodder for milch cows. He thought there was nothing better for a milk-producing feed. Mr. MUNSON thought the best feed was oats and green peas.

The winter meeting of the society was held at Burton farm, the home of CHARLES W. GARFIELD. About fifty of the members, with their families, had gathered before noon, but Secretary THOMAS BROWN was not there, and it was learned with regret that sickness in his family detained him at home. S. E. ROGERS was retained in the place *pro tem.* The minutes of the last meeting were read, and also Secretary BROWN's report, which gave a concise resume of every meeting during the past year. It was listened to with interest and ordered placed on file.

An adjournment was ordered until 1:30 o'clock to allow those who had brought their lunch baskets to discuss the contents thereof, and those who had not to gather around the hospitable board which Mrs. GARFIELD had spread with a most toothsome collation. Then a season of visiting was enjoyed, while some who were addicted to the horrible tobacco habit lighted their pipes and strolled around the beautiful grounds of Burton farm, resolving in their own minds, one and all, that they would make a visit to Mr. GARFIELD's pleasant home some time in the season when the flowers bloom and the birds sing. Upon expressing this thought to the ex-president, he insisted that every member should consider himself and family welcome at any time, and so expressed himself in the meeting following.

At the opening of the meeting in the afternoon, the subject of tomatoes

was brought up by President GARFIELD, and in the discussion which followed, Livingston's Favorite was given the preference over the Acme, and, indeed, over all other varieties, for productiveness, smoothness, both marketable and table qualities. ALFRED HAMA advocated later planting of the seed than usual, of both peppers and tomatoes. W. N. COOK corroborated the statement that late-sown seeds and rapid-growing plants were the decideratum for early fruit.

President GRAFIELD read the invitations from the several members to hold meetings at their homes during the year, and they were referred to the executive committee to make up the schedule for the year's meetings. He then gave his annual address, as follows:

LADIES AND GENTLEMEN:—Our society was organized in 1872, since which time monthly meetings have been held with creditable regularity. There have been ebbs and flows in the interest and enthusiasm manifested, but today the organization is stronger than ever before. There have been great changes in membership and officers, and the success of the society has been due to the disinterested efforts of a few people. The questions will come up occasionally, "What have we got to show for all this expenditure of energy?" "Has the effort paid?" On the debit side are the labors of the officers and members to make the meetings interesting and valuable; the annual fees that have been paid in by members; the sacrifices that have been made to attend; the losses engendered by absence from business to attend the meetings and duties imposed by the society.

On the credit side we have the good times we have enjoyed with friends whose sympathies and labors are in accord with our own; the information we have acquired by contact with people who know more about some things than we do; the brightening of our own views and methods by rubbing up against our neighbors; the crystalizing into better form our own ways of doing, through the stimulus of imparting correct information to our friends; the gathering by absorption of better ways of management, by seeing the methods our neighbors are using; the broadening of our lives by a knowledge of what others are doing, and the development of more defined views of the means to success and satisfaction in life, thus becoming better fitted to enjoy life and aid others in its enjoyment.

How does it look to you? Has it paid to maintain this society? Could not we swell the credit side to even more considerable proportions by giving a little more thought and attention to the work of the society? Activity with good purposes brings its own reward.

We can not go amiss in making the most of the days as they come to us, and the mere attainment of a livelihood is simply the first course in the foundation of real life. I feel that the freedom with which, in our society, we impart the information from our own experience which will aid others to a larger measure of success, or prevent them from making mistakes that lie in the way of success, is enough excuse for a continued existence. Our own lives are enriched and ennobled just in the proportion that we strive to assist our fellows. I have no sympathy nor patience with the method that brings emoluments in proportion to the ignorance of others.

Our meetings make a model school, at which we all willingly attend and seek the information we wish. There is no compulsion, no straight-jacket method, simply the most delightful means of acquiring information that, while aiding business and promoting happiness, adds to the general fund of information and aids in the general growth of the community.

We who live in the country and have to deal with nature's processes, which are the source of material wealth, are apt to forget that we are in the midst of a great university, with numerous courses of study before us, and the means for a broad education within our grasp. The question constantly confronts us, shall we sacrifice this education because we are not willing to look further than the acquirement of means to maintain existence? If our society can aid us to wider and more liberal views of nature's processes, to an appreciation of her beautiful forms, to the utilization of the knowledge of nature's methods in adding to our equipment for getting satisfaction out of the life that is given us, it is worth the expenditure of a large measure of energy in its maintenance.

I am not certain but in promoting the objects of our society, and interesting our children in the principles and practice that form the basis of success in horticulture, we may not be accomplishing as much in developing them for their life work as by

sending them to school to con lessons from books. It seems to me we can make even more of our society in this direction than we have done.

The man who makes his thousands in a single deal in real estate, who has added nothing intrinsically to the value of the land, may, because of his dollars, cut a wide swath in the community; but I count of far greater value to the world one who, through study of nature's possibilities, brings out an added flower or fruit of value to mankind; and while dealers in stocks and bonds and lumber and land may laugh in derision at our enthusiasm over a new peach that fills a place in the succession of fruits. or a new chrysanthemum with added attractions of form or color, we can in our ecstacy sorrow a little that so few of the people in this world know how to get the highest pleasure out of life by living near to nature's heart.

There is a wonderful field for improvement in the objects with which we deal, and the more we add to our knowledge of the things that lie nearest to us, the wider will open before us the door to the wealth of information, the acquirement of which will give to us the keenest delight.

I have felt at times that our society might have done more for the material assistance of its membership by uniting in purchases and in advertising to the world the array of products we successfully grew for market in our vicinity. But now that the Grand Rapids Fruit Growers' association has been so successful in this class of work, we can safely leave these matters to an organization devoted wholly to to the commercial side of horticulture, and give it our hearty support.

I suggest that our executive committee continue its efforts to secure proper recognition of our own and kindred organizations in the assignment of rooms in our new county building. While the strength of our organization lies in our method of meeting at the rural homes of our members, still, occasionally a gathering or an exhibit may be arranged with special reference to our city friends, in some building belonging to the people.

The objects of our society are such, it seems to me, as to attract to its membership ladies and gentlemen who live in the city. The accompaniments of a home which render it attractive, and which a knowledge of horticulture aids in securing, are numerous and of the highest significance. I wish this field of our work could be made more prominent, and thus attract to our meetings people who could bring to us delightful suggestions on the embellishment of our homes. It is not what we purchase, or what we secure from the aid of experts, in bringing horticultural attractions about our premises, that give us the keenest enjoyment. It is what we do ourselves. The suggestions we get from others, that we can utilize at our own homes, and that we are enabled to adapt to our own conditions, are the ones that arouse our enthusiasm and enhance the value of existence. May we not with reason widen our sphere of usefulness by increasing our membership from among those whose interest in horticulture is confined to the securing of added attractions to their own premises, even though their domain for this purpose may be limited to a single city lot and a bow window.

For twelve years you have seen fit to continue me as president of this society, and I have been more proud of the honor than of any position I have ever held; and in retiring from the position I assure you that I shall not divorce myself from the councils of the organization or lose one whit of my interest in its work. My home is open for you to enter at will with your meetings, and the families at Burton farm will expect, at least once in each year, to great the members of the society in a monthly meeting. Ths aim of our household is not to gather in the margins from successful horticultual ventures, but by experiment, example and suggestion to stimulate in ourselves and others a keener interest in the methods and objects with which horticulture deals, and which add to the pleasure of living in this world, not forgetting that the highest appreciation of nature's possibilities is, in itself, a love of the Power that governs them.

BURTON FARM, Grand Rapids, Mich., Dec. 22, 1891.

This address was accepted and ordered engrossed upon the records and a vote of thanks tendered to the retiring president, with many expressions of regret that he insisted upon retiring.

The election of officers for the ensuing year was then proceeded with, and resulted as follows: President, JOSEPH A. PEARCE; vice-president, WILLIAM N. COOK of Grand Rapids; secretary, THOMAS L. BROWN of Grandville; treasurer, E. CHASE PHILLIPS of Grand Rapids; executive board, in addition to the officers ex officio, C. W. GARFIELD, SLUMAN S. BAILEY, ASA W. SLAYTON, and THOMAS WILDE.

Treasurer E. C. PHILLIPS made his report. One year ago there was $49.60 in the treasury. During the year $59 was received and $52.20 expended, leaving $56.40 on hand. The report was received and adopted.

Then the topic of discussion assigned for the meeting was taken up, and ex-President GARFIELD called for a general expression of opinion from all present.

W. N. COOK spoke of the work of the horticultural commission of the Columbian Exposition in decorating the cities along the route. As an instance he mentioned that $1,500 had been appropriated by the commission for the decoration of Kalamazoo, and he suggested that something be done in that direction for Grand Rapids.

S. S. BAILEY thought the experimental stations used too much science and not enough practical work. He would like to see several kinds of wheat and fruit distributed and tested. He thought the experiment stations could be made of more lasting benefit with the experience of the farmers of the state than can possibly be obtained from the Agricultural college, because the knowledge attained would be of more use to the old people now present. He thought, too, that they did not sufficiently recognize women.

Ex-President GARFIELD explained the working of the experiment stations and told how the $15,000 per year to each state had been expended, some successfully and some as perfect failures.

C. A. FRENCH of Grandville thought it no use to ask farmers for information. He had found them so ignorant that they couldn't tell how much feed it will take to fatten a lot of pigs, or how much milk a cow will give on a certain amount of feed.

After a few more explanatory remarks from C. W. GARFIELD, in regard to the work of experiment stations, and calling special attention to the sub-stations at South Haven and upon the sandy pine barrens in Crawford and Roscommon counties, he explained that the experiment stations had horticulture and agriculture as the big end, but they had to humor the scientists a little, and allow them to experiment on vexed questions, like the sugar beet, for instance, and settle these questions forever and to the satisfaction of everybody.

H. P. BENNETT recommended sending for bulletins from the New York experiment stations, as he thought they were far ahead of those of the Michigan station. He thought there was so much difference in cows and their breeds that we should have a different kind of feed for each breed of cattle.

The executive committee was instructed to issue schedules for the coming year setting forth the places of meeting and topics for discussion. A vote of thanks was extended to Mr. GARFIELD and family for their hospitality, and the association adjourned subject to the call of the executive committee.

After adjournment the subject of a city market was discussed by several members, and the executive committee was asked to make that the topic for the next meeting.

BERRIEN COUNTY HORTICULTURAL SOCIETY.

OFFICERS FOR 1892.

President—ROLAND MORRILL.
Vice Presidents—W. A. SMITH, R. C. THAYER, W. L KANE, S. G ANTISDALE, L. H. RUTH.
Secretary and Treasurer—A. J. KNISELY.

The first meeting of the year 1891 was held Jan. 10. After some debate it was resolved to reduce the membership to fifty cents. President MORRILL offered to give fifty plants each of Warfield and Michel's Early strawberry to each person who was active and regular in his attendance. This offer was published and had the effect of very suddenly depleting Mr. MORRILL'S stock.

Jan. 24, 1891. The society met at Grange hall. The election of officers thus resulted:

President—R. MORRILL; *1st Vice-President*, W. A. SMITH; *2d*, S. H. COMINGS; *3d*, W. A. BROWN; *4th*, C. H. FARNUM; *5th*, D. JUDSON. *Secretary and Treasurer*, A. J. KNISELY.

President MORRILL thanked the society and spoke of the importance of keeping up this organization. He spoke of the way in which Oceana county people are pushing and advertising their fruits and lands. We can, if we desire it, have a good representation at the World's Fair.

Mr. WEBSTER asked about the Warfield and the Michel's Early strawberries.

Mr. MORRILL said the Warfield is a pistillate and Michel's Early is a staminate and is a good fertilizer for any pistillate.

W. A. SMITH moved that ladies be invited to join this society and attend the meetings without the payment of dues. Carried.

The president said the Grand River Valley society men take their wives and they have good meetings. He thought we ought to keep up our meetings through the summer and meet at each other's homes.

W. A. BROWN said the South Haven society has been in existence twenty years and they meet summer and winter. They work together. What one knows they all know.

S. H. COMINGS: I think our society owes thanks to our liberal-minded president for his effort to keep the society going. If you will come to my place I will give each one 100 or 200 cranberry plants and you can there see how they grow.

Mr. MORRILL said: If you will come to my place when berries are getting ripe you will see a good object lesson and see what you want to find out.

Mr. G. F. COMINGS talked on pear culture. He said we ought to be able to enjoy this delicious fruit from August to February. There are thousands of acres in this (Berrien) and adjoining counties well adapted to the culture of this fruit, that might be doubled in value in five years if set to pears. The ideal soil for pears is a black sand with dry subsoil. Next to this is a clay loam. Any good corn soil will do for pears. They can be grown profitably. A northern slope is preferable to a southern

exposure. If a clay soil, it should be thoroughly plowed and drained where necessary. Pears will bear much fertilizing. Ashes and bone meal are about the best. Barn manure is good. Any fertilizer is good that promotes good growth. Eighteen feet each way is recommended as the distance apart for setting pears; but we should be guided some by the variety of pear and soil. Dig large holes and have some surface soil placed in the bottom. The first year or two a corn crop between is good. The partial shade is a good protection. Any hoed crop is preferable to grain. Blackberries are less injurious as a crop between, while raspberries and strawberries are more injurious. Currants are desirable if you want any crop between. It is well to shade the trunks of trees one or two summers and winters. Wrap and tie building paper around them. In pruning make a medium low top. High tops are too much strain on the roots. It is desirable to cut back pear trees. For size, one-year-old trees, if of good growth, are preferable to large, overgrown trees. The larger the tree the greater the shock in transplanting. As to varieties, there is an endless difference of opinion. My idea is Anjou, Bosc, Bartlett, Sheldon, Clapp's Favorite. A western New York report names the Anjou as the most valuable pear. The Anjou has a weak stem, and is bruised by falling on the ground. I have wondered why the Bosc is so little planted. On account of being hard to propagate, nurserymen have discouraged its planting. Bartlett is extensively planted. It ripens when we have much other fruit. It is a very tender fruit to handle and is not so good a grower. In marketing I have recently used barrels and kegs. I make two grades: No. 1, large, smooth specimens, and all the rest are No. 2. It takes longer to wait for pears than for peaches. Moody says that a bushel of pears can be grown cheaper than a bushel of apples. As to dwarfs, my experience is limited. I planted 300 or 400 dwarfs 12x16 feet apart, and was so little pleased that I planted, in between, standards 16x24 feet. Dwarfs have too weak a hold on the ground and are easily blown over. My experience is that Clapp's Favorite and Bartlett are nearly as early bearers as dwarfs. Too much and too sudden stimulating might induce pear blight.

Mr. S. Cook asked whether there is any difference in varieties as to liability to blight.

Mr. Comings: Doyenné d'Ete and Clapp's Favorite and Souvenir du Congress are blighters. The Lawrence is a nice pear and seems to be free from blight, and is a good keeper.

Mr. U. B. Webster: The Doyenné d'Ete is going. It comes in with too much other fruit. I am surprised to see the Bartlett take third place. How soon does Anjou come into bearing?

Mr. Comings: Not much before seven or eight years. I should not plant Clapp's Favorite extensively. Would not plant Clairgeau everywhere. In many places it grows small and inferior. Angouleme is of poor quality.

Mr. S. Cook: I cut the blight out of a pear tree several years ago, and the tree seems to be healthy and bears well, but I do not know that there is any remedy for the blight. I have found certain varieties more subject to blight than others. Clapp's Favorite, Onondaga, and Souvenir du Congress blight badly. Do not cultivate late, or manure too heavily, so as to induce too rank, late growth. Pear trees do not need barnyard manure when young. They prefer ashes and bone dust. Angouleme, Anjou, and Seckel are not liable to blight. Bartlett is medium. I never saw any blight in the Kieffer, except one small limb. I think it is a good thing to cut off

the top of a tree that wants to run up too high. Cut when dormant. It is necessary to top off dwarfs. I have used salt on pear trees, but have not seen much effect from it. I think we may check blight by cutting back into sound wood.

Mr. HARRINGTON: I set out 50 pear trees, manured strongly, and they all died within six years.

Mr. S. H. COMINGS: I have been away and have not attended to my trees very closely, and I find some dead limbs, but the tree goes right along.

Mr. W. A. SMITH: We know nothing about the pear blight. The sooner a dead limb is cut out, the better; but it is not a sure cure.

Mr. S. H. COMINGS: A grower tells me that if pear trees are mulched, and not cultivated, and the lower limbs allowed to grow, that you will get more fruit.

Mr. C. W. WHITEHEAD: A man between Fennville and Douglas has a Standard pear orchard. It blighted badly. He kept cutting out. It bore largely. They were mostly dwarfs. I would cut back, whether blight or no blight, and your trees will bear largely.

On Jan. 30, the society met at Grange hall. S. COOK gave a talk on insect enemies. He said: A comparatively new enemy is the apple maggot. If it gets a foothold it will probably be as injurious as the codlin moth. The codlin moth lays its egg in the calyx of the very young apple. It takes about two weeks for the worm to develop into full size. It leaves the apple at night because there are no birds around then to pick it up. It climbs up the tree and hides under the bark, and in about two weeks hatches out a codlin moth. The common remedy is spraying. We generally use Paris green or London purple, one pound to 150 gallons of water. The apple maggot moth is smaller than the codlin moth. It is like a fly. It deposits its egg anywhere on the apple. It hatches out and eats into the apple. It lays its eggs later in the season than the codlin moth. Spraying is not effectual as against the apple maggot. It is best to have hogs or sheep run in the orchard to eat up the fallen fruit. When it hatches it goes into the ground and stays there till the next spring. Fall plowing will do some good. The best remedy for the tent caterpillar is cloths tied to a pole, and soaked with kerosene, with which burn their nests. For the canker-worm, spray as for codlin moth. The pear is attacked by the codlin moth to some extent. Cloth or paper bands tacked around the trees is a good remedy. Put them on about July first. Examine them in about ten days. In case the bands are used, the loose bark should be removed. I have caught over fifty insects under one band. Neighbors should combine, as the moths may fly from one orchard to another. There is one pear-leaf enemy called the cherry slug. The easiest way to manage this is to take fresh-slaked lime and dust it on when the leaves are wet with dew; or dust or sand will do for young trees. Old trees I would spray. Dry sand in hot sunshine is a good remedy. In spraying cherry trees, the solution must be weaker than for apples. The peach is more affected with borers when the trees are young. The eggs are laid by a little insect, about the first of July, near the surface of the ground. After it is hatched out it eats through the bark, and, if undisturbed, girdles the tree. The only way to get him out is to dig him out. I have removed the earth from around the trees and coated the trees heavily with thick whitewash and then returned the earth. I am of the

opinion that curculio live from year to year for several years. Of all the remedies tried, the only sure one is jarring upon a sheet. Some practice spraying. Prof. COOK has never been able to destroy all of them by spraying. It is only a partial remedy. When we spray peaches we must be more careful. I think one pound of Paris green to 200 gallons of water would be strong enough. [Mr. MORRILL said that Prof. COOK had come to the conclusion that the peach foliage would not stand poison strong enough to have any effect on the curculio.] You must be very careful about jarring cherry trees, they are so tender. The Ransom process (placing chips, etc., on the ground, as traps) is a good remedy if all would adopt it. First remove all rubbish from around the tree. The aphides suck the juices. Spraying does not kill them. The only remedy for black-knot is cutting off the affected limbs. But there are insect friends. I have discovered millions of ladybugs on the edge of the beach. They ascended the bluffs and went to business and destroyed the aphides. It is only by the combined efforts of fruitgrowers that some of these enemies can be held in check. Without these friends and certain fungi we could not live.

W. L. GEORGE asked about spraying apple trees.

Mr. COOK: I would not spray when they are in blossom, but would very soon after; and a second time, about ten days after the first spraying, if there are no rains. If it rains, spray again soon after.

Mr. WOODRUFF: Have managed the tent-caterpillar successfully with a swab on a pole and strong soap-suds.

W. A. SMITH: I would advise to not spray apple trees with a solution stronger than one pound of poison to 200 gallons of water, and even then you will destroy the foliage if you do not do it right. I have taken five or six heavy crops of plums where I sprayed. I think the cherry leaf will stand as strong poison as the apple will. So few pears are stung that it does not pay to spray them. Use the same strength of solution for apples, pears, and plums. Suppose we try spraying on our peaches, one pound to 500 gallons.

Mr. COOK: I think, from my experience, that the cherry and the plum will not stand as much as the apple.

Mr. JUDSON: I have sprayed with Paris green, London purple, and arsenic. The Baldwins are the most easily injured. Spraying (one pound to 200 gallons) worked well on plums and cherries, but killed some peaches. I would not use stronger than one pound to 400 or 500 gallons of water.

Mr. HARRINGTON: Coal ashes for plums is a good remedy.

J. H. WATSON: A certain party had killed $1,000 worth of apple trees by spraying, and I think that we can kill the foliage with cold water alone, without any poison.

Several persons cited instances where cold water had killed trees.

Mr. MORRILL: Prof. COOK says that the peach borer's eggs are deposited about from July 1 to 6 or 8. Remove the earth and wrap tarred paper around the trees, about six or eight inches high, and leave it there. Fasten it with a tack; or tack a screen around the body of the tree; or take slaked lime (one bushel to one pint of carbolic acid) and put a handful around the tree about July 1. Another remedy: When you "grub" your trees, carry a bar of hard soap and rub it into the tree. Another insect is the currant borer. The saw-fly deposits its egg at the junction of the leaf and stem. It bores in and works up or down, and comes out

about May 1, a perfect insect. In the spring (about the last of May) the stem shows dead and may readily be cut out. It is bad on Fay and Red Dutch, but not on Victoria, because the inner bark is of a firmer texture.

W. A. SMITH read a paper on grapes.

Answering questions, Mr. SMITH said he had had but little experience with the Brighton grape. Others said it was a failure. Mr. WATSON spoke in favor of the renewal system of pruning. Let new sprouts grow, and cut off the old vines. One objection to this plan is, they sucker very badly.

Mr. WEBSTER: You can save your grapes by spraying.

Mr. JUDSON: Is not the reason why there is not so much rot on renewed vines, that where there is no crop for a year or two there is not so much old grapes and spores?

H. MERRY: My vicinity is not a suitable place for grapes, yet I have made something on them, but not on berries nor plums. I got nine tons of grapes off from seven acres, which is not a very good crop. I have tried the Bordeaux mixture, but do not think I sprayed early enough. I think we ought to spray as soon as they begin to bud out, and would spray and soak the vines. I sprayed all but two rows. They showed great advantage from spraying. Mr. Crittenden used it and he has not much rot. I think rot spores blow in the air and go from one grape cluster to another and to the foliage.

Mr. MORRILL: I think if spraying is not general we can not get the best benefit. No question but the spores of rot are light as air and blow everywhere.

In the meeting of February 6, Mr. U. B. WEBSTER read a paper on "The best fertilizers, and where to procure them:"

This is a question that should receive the attention of every tiller of the soil. It is one of the most imporant subjects connected with farming. No agriculturist or horticulturist can afford to ignore or neglect this all-important matter, for no man, be he grain, stock, or fruit grower, can for any great number of years produce paying crops without fertilization, for it is a law of natural economy that you can not constantly exhaust without replenishing. The source will fail eventually.

What food is to the physical system, what light is to the material universe, what intellectual culture is to the mind of man, so fertilization is to the field. Everything must be fed or it perishes, Dr. TANNER and other fanatical abstainers from food to the contrary notwithstanding. That our lands will wear out if they are not enriched needs no argument here. All admit this, and the question at once resolves itself into this query: How can we best improve them, how best increase their productiveness? It is not my province, neither is it necessary for me, to enter into a chemical analysis of the various soils, or even the various fertilizers provided for us. Suffice it to say that we all realize the fact that our lands must be enriched; and now, how can we do this the cheapest and most effectually?

Of all fertilizers, I regard clover as the cheapest and best, the easiest obtained, and the easiest applied. In fact, it is indispensible to the grain farmer. He understands its value and the mode of applying it thoroughly, and many of the fruitgrowers might and do use clover to advantage. Next after clover comes rye. This is being used to a considerable extent by many of the fruitgrowers, especially by those who grow the vegetable fruits, such as melons. The melon-growers all, or nearly all, plow under rye. Rye is an important article in this direction. It is shown on pretty good authority that a crop of rye sown early in the fall, so that it may get sufficient growth to cover the ground well, will more than pay for all trouble and expense, even if it is plowed up in the spring before it attains much of any growth. It is said that it is better for the ground that it have some kind of vegetation during the season of heavy, drenching rains, from the fact that the roots of the plants take up the nitrogen, which is so essential to plant growth, and hold it; whereas, if no vegetation was there, the nitrogen would be washed down by the percolation of the water and lost.

And here let me digress a little from my theme and say that many of us have come to regard chickweed as a friend and benefactor instead of a noxious and troublesome weed for this very reason.

Rye should be sown early in September. I think we could sow rye to good advantage among our berries. By getting a one-horse drill we need not then scatter it in the rows, but can sow close to them and then it can all be plowed under. All, I think, can see the feasibility and practicability of this. Of course, rye is not so good, not as rich, as clover, but for the fruitgrower it is more practicable, Not so with the grain-farmer. He has the advantage of us in the use of clover. These two are the only green manures, but we will do well to give heed to their utility.

Now let us consider the dry or solid fertilizers. First comes stable or barnyard manure. With this and the mode of applying it, all are familiar. Some claim that it it is better to compost it and apply to the surface of the ground, working it in with a cultivator or harrow. Others say, spread it and plow it under in a coarse or raw condition. Either way is good, but for the fruit-farmer I consider the first plan the better. My neighbor, Mr. Bertram, is considered one of our best cultivators, and one of our most successful fruitgrowers. He follows the compost plan, hauling the manure out in the spring and scattering broadcast among the rows and working it in. There is another advantage in the compost heap, in this, that the heat of chemical transformation destroys many of the noxious seeds that abound in stable manure. I might say a good deal more about stable manure and the manner of applying, but this a familiar subject and all of you understand it.

Let me say, use all you can get of it; compost it, or use it raw.

I have lived in places where stable manure was a nuisance. In Kentucky I have seen log stables taken down and moved for the sole and only reason that the manure had accumulated in such quantities in and around them that to get the horses in or out of the stables was next to impossible.

I heard a farmer in Iowa say, "Dod rot the stuff; I'll never haul out any more of it; it makes too many weeds grow." But not until Benton Harbor and St. Joseph each shall have obtained city charters and greatly increased their population and extended their borders, will the fruitgrowers have a sufficiency of this important fertilizer.

Now, about the dry or solid fertilizers, and we have a host of them under different names and brands, for they have come into such general use, and there is such a demand for them, and such a profit in their manufacture, that the market is flooded with all kind and conditions. I am disposed to regard them with favor, for while I think many of them are almost or entirely worthless, very many of them are good. You all know as much about them as I do, and many of you a great deal more. I believe the basic ingredient in many of them is simply blood, and blood is a cheap commodity in our cities. There are a great many different brands and a great many different chemical analyses, and we can only tell which are the best by an actual test. One who has used these commercial fertilizers to any considerable extent, is qualified to give testimony in this case. It is not my aim to exhaust this subject, or to cover the whole of the ground, but this paper is intended simply to give some of the writer's ideas and to draw out discussion.

A. J. Merry said that he used some barn manure, spreading it on the ground during winter and spring, but did not know that he had seen very much benefit from it. When in the east he had seen commercial fertilizers used on corn and wheat, with very beneficial results. He had used Lister's fertilizers in the east, and found them good.

B. F. Pixley: Dunbar's fertilizers are good. Nitrate of soda, which costs $55 per ton, is good on any kind of vegetation. I use it dry, in the hill.

R. Morrill: I have used a ton of nitrate of soda, and have seen no benefit.

W. A. Smith: I doubt whether green rye plowed under is a fertilizer. But ground exposed during cold winter will deteriorate, and anything that will hold the snow is beneficial. Rye takes from the soil all that it returns to the soil; but, plowed under in the spring, it has a good effect in retaining the moisture. The cow pea is a good crop to plow under. I tried bone meal on potatoes—a handful of meal on each hill. It had a bad effect, but that was because it was a dry season and the bone meal just lay

there. We must raise good crops to be able to use much commercial fertilizer. I would plow rye under just when it came into bloom.

Mr. MORRILL: I have plowed rye under when the ground was dry, and, no rain following, it proved a detriment.

Mr. WEBSTER: I have faith in rye as a fertilizer. Mr. MERRY read a paper before the Baldhead club, showing that rye was beneficial by the roots holding the nitrogen.

Mr. MORRILL: I suggest sowing bone meal in August, and sowing the rye on that and plowing the rye under.

G. F. COMINGS: Bone meal is a slow fertilizer. I do not think we can expect much result the first season. It is a good fertilizer for pears and grapes. I do not think you will see much effect on a pear tree, from bone meal, the first year. I have used special fertilizers with good results the first year, and have used wood ashes a good deal.

ORIN BROWN: I have had some experience with rye; have plowed rye under for three seasons, just when in head, and planted tomatoes, with good results. Some of the rye, when plowed under, was as high as a horse's back. I have followed rye with buckwheat and potatoes; used no other fertilizer on my tomatoes, but we had continuous heavy rains after plowing the rye under.

A. BRUNSON: Mr. Hill, near Spink's Corners, always sows rye in the fall, and plows it under in the spring, in his orchard, and I never saw finer apples than he raises.

R. MORRILL: Rye sowed in August or September and plowed under in spring, using some bone meal, is excellent for peaches. The fertilizer made at St. Joseph contains nitrogen and phosphoric acid, but no potash.

J. H. WATSON: Cotton seed meal is used in the south.

R. MORRILL: It is one of the highest forms of nitrogen. The Connecticut experiment station has published a very complete report on commercial fertilizers. I have used Mapes' fertilizers and found them valuable, even at $55 per ton. I have bought the ingredients and done my own mixing and saved $20 per ton. The question is, who will furnish the nitrogen and phosphoric acid the cheapest.

Mr. MARTH, (Lister's agent): We have been manufacturing for twenty years. You should not put phosphate into contact with the seed, but it should be well mixed with the soil.

D. BOYNTON: Peach trees around which a little handful of sulphur had been placed, are as large again as other trees of the same age.

Mr. MORRILL: Tankage and azotine work well the first year.

D. JUDSON: I have used tankage, but have seen no gain from it.

Mr. MORRILL: If the land is worn this fertilizer needs potash with it.

Mrs. H. E. JUDSON read a paper on Floriculture.

The pleasures and benefits to be derived from the cultivation of a flower garden, a nice lawn with trees, shrubs, and flowers well arranged, are innumerable and can hardly be overestimated. In thus making our homes attractive, we not only increase their money value, but indicate to the passer by that we are intelligent, refined, home-loving people, who understand the forces used in molding character. To love and cultivate flowers is one of the few pleasures that improve alike the mind and heart and make every true lover of these beautiful creations, wiser, purer, and nobler.

Flower gardening for women and children is conducive to good health both physically and morally, and to the development of that sunshiny spirit which makes the gladness of every home. It should be the ambition of every woman to make her home the most lovely spot on earth to her family, and no one thing will help to do this more surely than the flowers. Boys and girls alike will learn to appreciate them.

When winter comes and desolation reigns without, the good home-maker knows how to keep it summer still by gathering into nook and corner part of the summer's

glory. It is strange that we do not value flowers more than we do, because they are capable of adding so much to the beauty and attractiveness of our rooms. We fruit-growers, who do not have as much money to spend for fine furniture and the elegancies of life as we'd like, ought to be the first to utilize our flowers.

Do not say that you have no time to care for flowers. It is surprising how easily the time is found, when once you are interested in your flowers; and more surprising to find how much more easily you can do the regular house work after spending a half an hour digging in the flower beds or watering and caring for the house plants.

The first requisite for success in floriculture is a love for the work; the second is common sense, and the third is untiring watchfulness. One of the greatest obstacles to success with house plants is the dry, overheated atmosphere of our living rooms, which is harmful alike to plants and to man. It would certainly be a benefit if the temperature of our rooms could be regulated so that plants could thrive therein.

Do not try to cultivate too many flowers. Select a few varieties to begin with. I should prefer begonias, geraniums and primroses for the house; and pansies, sweet peas, alyssum, and ageratum, with your roses, lilies, and other bulbs, are quite satisfactory for the garden. There is no need of spending any money, if that be an objection. You will find plenty of friends who will supply you with slips or plants, and tell you all they know of their habits and needs. Neither is it necessary to keep fires during the night for a few plants. Get a box, paper inside and out, hang the cover with small hinges and when a cold night comes stow your plants in this and they will be safe.

Enlist the children's interest. The influence of flowers as an educating force in home life is not always thought of. The plants, indoors and out, need regular, systematic attention; here is a chance for your first lesson—care. Neatness in arranging the flower-bed, in placing the window plants so that they may be kept clean easily, inculcates order. Study harmony of color and general effect in grouping different varieties, so as to give the most pleasing result, thus cultivating a taste, so much needed in choosing articles of dress or furnishings for our homes. Our powers of observation are quickened, and by learning to notice the beauties of nature, we increase our capacity for a life-long enjoyment.

U. B. Webster: I appreciate beautiful flowers but have no time to devote to them.

Mrs. Withey: Do not think that plants in a living room are unhealthful. You can have roses from June till November. The hydrangea is hardy and beautiful.

W. A. Brown: I am glad of the suggestion of a box for plants on cold nights. There are many beautiful wild flowers. I think roses and other plants need renewing.

A. Brunson spoke of a town where he had been which had the name of the place in foliage plants, which was beautiful.

Mr. Pixley: The best roses for out doors are the best hardy hybrid perpetuals.

Mr. Withey; Roses are great feeders, and must be trimmed out and some cut off entirely. George the Fourth is fine for fall blooming.

Mr. Crooks: To raise flowers successfully requires much work.

Mr. Withey: Rose bugs do not trouble my grapes. preferring the rose bushes.

Mrs. Brown: The bugs eat all of my roses and are then in time for the grapes.

Mr. Judson: The flowering currant and the lilac are beautiful and are no trouble.

Mrs. Judson asked about having blooming lilacs in the house.

Mr. Pixley: Put your lilac in the cellar, and when ready put it into a pail of water, and in two weeks time it will be in bloom.

Mr. Morrill: If you want to sell a place, two or three hundred dollars invested in ornamentation will pay well.

Mr. Pixley spoke of a place which could not be sold because there were no shade trees around it.

At the meeting of Feb. 13, 1891. Mr. MORRIL read this paper on "New Fruits."

This subject is one of more than passing importance, as the progressive fruitgrower of today knows very well that the only way to make any money at the business is to keep at the front in all matters pertaining to his business, and one of the most perplexing of our problems is to discover the real merits of any new variety soon enough to reap the benefits from growing it, if it is any improvement over old standard varieties, before everybody else has it; or, in case of loudly advertised varieties that have no advantage over old varieties, to let them alone. The man who can determine these matters correctly before the fruits are in general cultivation, can make a fortune growing fruit; but the obstacles in the way of gaining such reliable information are so numerous as to make the business largely experimental, even among the best informed. Consequently, when we give our experience, it must not be considered positive evidence of value for all, as the difference in soils, location, treatment, etc., may make all the difference between success and failure. In short, the only positively reliable information you can get is to test them yourself on your own land and in your own manner.

In discussing the merits of the new varieties I shall name some that are very promising in other hands but have never been tested here. First in order, perhaps, comes the apple. Among the new things offered, the most prominent is the Yellow Transparent, a beautiful early apple, which is fully described by its name. It is earlier than the Early Harvest, very hardy and productive, and should be profitable here.

In pears it is very doubtful if we have any new varieties more profitable or reliable than the old Bartlett, Clapp's Favorite, and Anjou. The Kieffer has had a great boom, but so far it has been on its merits when grown several hundred miles south of here, where it has certainly done well; but our seasons seem to be too short for its full development. Consequently I consider it of doubtful value here. The Garber is another candidate for favor, of the same type, but said to be much better in quality and some four weeks earlier, equally as productive, and free from blight. If these claims are sustained it is a good variety to plant. The newest variety is the Idaho, for which every good quality is claimed. It is supposed to be a seedling of the Bartlett, of high quality and great productiveness; but a man would need a good bank account to set many trees now. The new early pear, Wilder, is receiving high praise, and may be a good thing where early pears are wanted. It is at least desirable to test all the above varieties in a small way.

Next in order we will take the peach. In this class candidates are plentiful, and I suppose most of them have some merit, but for us there are but few needed, as there is some very reliable old sorts to which we can add some of the race of hardy seedlings which has sprung up on this lake shore, among which we will name Brown's Early, Lewis, Crane's Early Yellow [St. John, really an old variety], and Gold Drop. These all have great value on account of their extreme hadiness and great productiveness, besides coming into bearing earlier than any of the old standards. Our greatest need has been for a peach to take the place of the Crawfords. For this position there have been several candidates, but so far all have developed some weakness; but in the Elberta we have one which bids fair to fill the requirements, being very hardy, a good shipper, and even more satisfactory on the market than Crawford.

In the line of small fruit I do not think we have any new varieties of blackberry that can equal the Early Harvest, Wilson, and Lawton for a full succession. Of the red raspberry we have no thoroughly satisfactory variety, new or old, and are not much better off in black-caps. Still, there is more progress making in them than in the reds. I have tested the Palmer and am very favorably impressed with its value as an early, heavy-cropping variety.

In strawberries the new varieties are endless. Our standard for years has been the Crescent and Sharpless, and by them we measure the new things. After testing something like a hundred of them, I will describe a few that seem to have special merit. Bubach seems to do well everywhere, averages larger than Sharpless, will yield twice as much, easily; of very good form, too soft for long shipments; bloom, pistillate; very late in pushing up buds, thereby escaping frost, but ripens quite early. Warfield is the champion market berry at present. It is a pistillate variety, more productive than Crescent, much larger flower, like the old Wilson, very perfect form; fruits look as if they were varnished, and will ship further than any other variety we have, but must positively be kept in very narrow rows or hills or it will prove worthless. Haverland is also a very desirable pistillate variety, but has one serious fault, that of pushing its fruit stems out along the ground; and if not mulched, fruit will all lie on the ground.

Michel's Early has not been so well tested here, but pronounced by growers where it is grown the best thing introduced for years. Staminate bloom, resists frost perfectly, ripens a week or more ahead of the Crescent, is very productive of large, firm, heart-

shape berries of high flavor; grows stronger on light soil than any other variety; a good pollenizer for any variety. Lady Rusk is of the Crescent type, very productive and extraordinarily firm, but has the defect of bearing numerous split berries. Of the newer varieties I am more than favorably impressed with the Crawford and Parker Earle, but it will take another year's test to determine their value.

Among red currants, the only new thing is the Fay, and so far I have never seen a man who has made a success of growing it, although it has been a grand success as a seller.

The new black, Crandall, will hardly prove to be all that has been claimed for it, and as a market variety I see nothing so far to recommend it.

S. Cook: Have no trouble in ripening the Kieffer pear, but would not set it when liable to early fall frosts. It is very hardy. If going to set only three varieties of pear, one of them would be Kieffer. It grows as large as the Bartlett. Le Conte is worthless. I would as lief have a turnip to eat. The Kieffer is free from blight, is not so good as the Bartlett for eating, but is the best for canning and is the strongest grower. It always outsells all others, and keeps till the holidays. There is no money for us in any early pears, because they come in competition with southern fruit.

Mr. Pixley: The Kieffer is always of good size, if the tree is not overloaded. It has shown no appearance of blight. It has more character and flavor for canning than any other variety. The Le Conte is not worth cultivating in this country.

In answer to questions Mr. Morrill said: Gandy strawberry is a good late berry, but not very prolific, and a good proportion of them are "buttony." I suspect that Lovett's Early is Michel's Early.

Mr. Cook: The Bubach is a fine berry and a good bearer, but makes but few plants. The Gandy is a fine, large, late, firm berry, and sells well, but does not bear well.

Mr. Morrill: The Jessie needs a location free from frost. It sells better than any other berry, being 25 cents per crate ahead of anything else with me.

Orin Brown: I got the Jessie from Chas. Green. It is a poor bearer on clay loam. The first few pickings were nice, after that it ran small.

Mr. Morrill: Bubach is late in blooming and escapes the frost, but is not firm enough. Sharpless and Jessie both kill in the bud on my land. Jessie outyields Sharpless. As I saw the Gold Drop peach at South Haven, it overbears if not thinned. It is hardy. When thinned it is about as large as Crawford.

S. Cook: If Barnard is thinned it grows large.

Mr. Conley: I think that Gold Drop has more credit than it deserves. Do not rely too much upon it. The Kalamazoo is very nice, but spots badly.

Mr. Morrill: I would not set the Gandy. Louise is a soft berry, quite large, bruises easily, not a good carrier, subject to blight. Pearl is fine, but subject to blight. Cloud is not very valuable, soft, depressed seed, nothing desirable in it. It makes very many plants. I wish you would keep watch of the Parker Earle. I think it is an excellent berry.

Mr. Judson: I have a few plants of Thompson's Early Red raspberry. It is rather small; does not bear extra well.

Mr. Mead asked about using salt about pear trees. He had used it and had not had any blight, but does not know that it was the salt that kept the disease off. He used about a peck to the tree.

O. Brown: I have four pear trees on my place which grew well and bore heavily until about ten years old, when they commenced blighting.

I put salt and coal ashes around them, and since that have seen no blight. I also cut them back. I had four Flemish Beauty. They commenced blighting year before last. They were in sod. I cut back and salted, and tried linseed oil, but it did not check the blight.

W. A. SMITH: Salt is not a fertilizer. It is only good as a retainer of moisture. As to the blight, we can not tell anything about it.

S. COOK: Young trees are seldom attacked with blight; not generally until they come into bearing.

Mr. SMITH: Some say that it is a fungus, but nobody knows. There certainly is no remedy. When the limb is struck, the first thing we know the limb is dead.

Mr. CONLEY: Of peaches I would set St. John. Oxford, Hinman, Richmond, Red Cheek, Kalamazoo. and Gold Drop. Switzerland is excellent. Cloud strawberry is the hardiest and the best shipper I ever had; seeds quite prominent, but rather small.

President MORRILL read proposed law against spraying trees, etc., when in bloom, at the meeting of February 20.

W. A. BROWN: I am opposed to lumbering up our statute books with laws. It may be true that bees would be poisoned by collecting honey from blossoms that were sprayed with poisons.

W. A. SMITH: I am opposed to such a law, because people who know anything about it would not spray with poison when fruit trees are in bloom.

Mr. COMINGS: I think the law ought to be passed, as a means of educating the people.

Mr. MORRILL: There is a demand for such a law.

Mr. WEBSTER: I think there is no harm in such a law.

Mr. SMITH: People ought to be educated as to when to spray.

Mr. S. H. COMINGS: People ought to be educated. and I am in favor of the law.

Mr. COMINGS proposed the following: "*Resolved*, That we are in favor of the passage of that law." Carried.

Mr. MORRILL stated that there was a bill pending for preventing hunting rabbits with ferrets.

Mr. SMITH: I am in favor of offering a bounty on rabbits.

Mr. COMINGS: I am in favor of destroying rabbits.

Mr. WEBSTER: I would place no restriction on the destruction of rabbits.

Mr. MORRILL: I regard rabbits as a great nuisance. as great as rats, and would put no obstacle in the way of their destruction.

Mr. COMINGS offered the following: "*Resolved*, That we are not in favor of such a law."

Mr. SMITH offered, as an amendment, that we recommend that the state offer a bounty for all rabbits destroyed. Carried. The resolution as amended was passed.

The secretary read a paper by W. L. George, on "Marketing Fruits."

I assume that a "snide" package of fruit is one that has been dishonestly packed, one that contains from fair to gorgeous fruits on top with inferior or worthless fruit in the middle and the bottom. I have bought many such packages of fruit for shipment. I have found small apples in the bottom and middle of baskets, with fine specimens of peaches on top. That is what I call "snide" packages. I believe the size of an honestly-packed package of fruit is a question of loss or gain with the shipper rather than one of conscience. I would hail with joy the era of uniform fruit packages of full size,

from the three-bushel barrel of apples down to the pint berry-box. I believe it would be a great advantage to the shipper. The cost of gathering, freight, and cartage would be the same. If the commission on sales is more we would not complain.

If it rested with the members of our society, the question could be settled at once in favor of large packages. But we are only a small part of the fruitgrowers of the country. The great majority will continue to put up their fruit in the package that they can see the most money in. I can see but one class that is benefited by the small package, and that is the pickers. And they very often get all there is in the crop.

About fifteen years ago the same question was discussed in the grange of which I was a member. After much discussion we came to the conclusion that there was but one way to secure a uniform package, full size, that was through the manufacturer. I was a member of the committee to labor with the manufacturers. I spent a number of days and was at some expense. I visited every manufacturer of packages in Berrien county, and without an exception they pledged themselves to manufacture nothing but the full-size packages, and that the style should be uniform. I was one of a number who pledged themselves to use nothing but the full-size basket and crate for the season. I stuck religiously to the contract. Some of the strongest advocates of the large-size packages were among the first to switch off to the small one. It was but a short time before the market was flooded with a trifle smaller package than had been in use before. The excuse of the manufacturer was that their patrons demanded something smaller than the full-size, and if they would not furnish it the growers would get what they wanted in some other place. Some even complained that, through the action of that committee, they had lost money, as they started out in good faith and manufactured more full-size crates and baskets than they could sell. After my experience of that year I concluded to do as a large majority of growers do. That is, to use the package that would bring me the most skekels.

Fruitgrowers are not all shippers. Very many of them never ship a package of fruit to market. They sell to speculators, who will pay the same price for a small package as for a large one, with perhaps the exception of apples. Even our small packages are repacked, in Chicago, into smaller ones and sold to the consumers.

I know of no way to remedy the evil. Some say, have a law passed making it a crime to offer fruit for sale in any other than full packages. We have a law prescribing the legal size of an apple barrel. That does not prevent the putting on the market of a much smaller package of apples. The law only prescribes the legal size. Again, what is known as the "snide" eight-pound basket for grapes, with the raised rest, will hold ten pounds of well-clustered and well-packed grapes, and perhaps less than eight pounds of grapes that have been thinned by rot or frost, and the eight pounds sell very often for as much as the ten pounds, unless the shipper of the ten pounds has a reputation of shipping nothing but first-class fruit. The reputation of the shipper has more to do with the selling price of the fruit than the size of the package.

I believe the fruitgrower who cultivates the crop, and who has to contend against frost, drought, flood, and other elements, that often seems to combine against him, together with all of the insect enemies, low prices, and the greed and avarice of the commission man, who holds the hard earnings of the grower in the hollow of his hand, has the legal and moral right to offer his fruit for sale in any size or shape of package he may select.

Mr. White, representing a Detroit company, said that if his company were offered sufficient encouragement they would manufacture paper fruit packages here.

Mr. Comings: If they manufactured the wooden berry box also they might work in their paper box by degrees, if it was found desirable.

Mr. Pixley: Parties who had dealt with the Mt. Pleasant company last year were in favor of dealing with them again; but that the St. Joseph company bought them out; now we have formed this new organization. We expect to keep the $5,000 as working capital, each member to pay for whatever he orders,

Mr. Mead: I am in favor of contracting with any good party who would offer packages at lower rates, and standing by him, regardless of prices offered by other manufacturers.

W. A. Brown: Heretofore any effort in this direction has been headed off, but we never tried it with money invested.

Mr. SMITH: I am in favor of the stock company and am willing to take stock in it.

Mr. BROWN: I am in favor of this company, and hope they will sell to poor outsiders.

Mr. PIXLEY said that through this new organization they hoped to get advantages in selling fruit by car lots.

Mr. WEBSTER: The trouble last year was the short crop. I had bad luck in shipping to Anderson. We are at the mercy of the commission men.

Mr. MORRILL: Our effort last year had the effect of opening up new markets and thereby relieving the Chicago market.

Mr. HANDY: No doubt the circulating of those pamphlets had a good effect.

S. H. COMINGS: Cranberry-growers adopted a stencil, and it is recognized as a guaranty of quality.

Mr. PIXLEY: We ought to guarantee that fruit is equal to its appearance.

On February 27, the secretary read a paper from W. A. BROWN on Marketing Fruit.

The growing of perishable fruits as a business is a most fascinating occupation, notwithstanding the constant cares, perplexities, and frequent failures which must be encountered. But no one should engage in the business before carefully considering the adaptability of soil, climate, and location in reference to remunerative and accessible markets.

Perhaps no locality in the northwest is better adapted to general fruitgrowing than western Michigan; and certainly no other place in this latitude has so many of the conditions necessary to the successful cultivation of small fruits as our own Berrien county.

Strawberries were first grown in 1862 for the Chicago market. The first raspberries and blackberries were shipped in 1864; and the high prices prevailing caused large plantings in the then comparatively small fruit area around St. Joseph. With the rapid growth of western cities and the fast increased consumption of fruits, our small beginnings have become an immense industry with thousands of acres in fruits. Nearly all of the people of our lake shore towns are dependent, directly or indirectly, upon the financial results of the business of fruitgrowing.

The demand for fruits by the non-producing classes is almost unlimited, provided that good fresh fruits can be obtained at all times and in all places at a moderate cost. How to meet the demand for fruits upon an economical basis which will induce large consumption and leave a fair profit to the grower, is the problem which large fruitgrowing communities are being called upon to solve.

Without entering into details, we will allude to methods for transportation and marketing fruits which are being perfected by co-operation in several large fruitgrowing districts. The California Fruit Union has developed a system by which their fine fruits are placed in markets two and three thousand miles distant in perfect condition. This has been done by the relinquishing of all claims by the growers to their agents who have full control of all exports, and who virtually own the fruit. Upon arrival in the eastern cities the fruit is sold at auction to large buyers, who sell to local dealers. By the perfect packing of good fruit only and transportation in refrigerator cars, California fruits have become a staple production with values fixed by supply and demand. The growers of citrus fruits in Florida are perfecting a system, by which their association gives the exclusive control of all shipments to their own agencies.

The Delaware Fruit Exchange, whereby peaches were sold at auction from growers' wagons, proved efficient and satisfactory during prolific seasons, but owing to recent failures in the peach crop has remained dormant. Much of the immense supply of small fruits grown for the eastern cities is sold to dealers; but the old system of daily consignments by individual growers to commission houses is the only efficient method available for closing out large daily shipments of berries. Midway between eastern and western markets, the fruitgrowers of western New York are organized for the co-operative transportation and marketing of their fruits. Car and train loads of grapes are moved east and west and placed upon markets selected by their own agents. Our southern friends

have been slow in securing all of the advantages of their location for supplying the great northern demand for early fruits and vegetables. The long line of production in the lower Mississippi valley has generally made Chicago their distributing point; but through individual enterprise, and organized co-operation of growers at large fruit-growing centers, car loads are being sent direct to many large cities without paying tribute to Chicago.

Having given a cursory glance at general methods of marketing fruits in other localities you will expect some allusions to our own system, and references to proposed reforms which are being suggested by growers at the principal shipping points up and down our lake shore.

During the early years of fruit shipping from the St. Joseph region, Chicago was the only market, prices were high, and the commission system satisfactory. But periodical gluts of some varieties of small fruits soon occurred, though we never had a positive glut of peach market. While we must continue to rely upon Chicago as our principal market for small fruits, we should be prepared to utilize a surplus by shipping to other points or selling at home to manufacturers of fruit goods. We can not foresee the contingencies of the season; last year one half of the immense crop of strawberries went to waste; our blackberry crop would all have been sold at home had shipments been withheld, and the entire crop of grapes, apples, and pears grown in this country could have been sold at Benton Harbor, if offered for sale at that point and buyers notified of the withdrawal of the fruit from other markets. But during seasons of general fruitfulness, combined and intelligent efforts will be required all along the line by fruitgrowers if remunerative prices are realized.

Many fruitgrowers ignore the efforts of fruitgrowers' societies; they plod along in the old ruts and characterize the members of horticultural societies as "Threshers of old straw," but they are finally compelled to adopt new varieties of fruits, new methods of cultivation, and recent appliances for exterminating insect enemies or "get left." It is true that horticultural societies are not strictly business associations, but all questions pertinent to the gradual evolution of the material interests of the fruitgrower are discussed and the formation of efficient business organizations suggested and encouraged.

Last year the Berrien county society issued a large number of pamphlets inviting fruit dealers to purchase and order their supplies directly from the grower. Several hundreds were sent to dealers in many towns, and more will be distributed which will probably bring forth good results in a more prolific season. But a business organization will be necessary through which the quality and quantity of the goods will be guaranteed, and a large number of growers pledged to supply all legitimate demands. Our society has also effected an arrangement with the express companies whereby the tariff of rates on fruit to all points are greatly reduced. And now the South Haven, the Saugatuck and Ganges societies are considering the sizes of packages in which the coming peach crop shall be marketed. It appears that many of the Allegan county growers think that a fifth-bushel will sell at the same price of the full peck and will use all sorts and sizes of packages. The South Haven and Casco society are placing themselves on a business basis, as the following, which was signed by the members of their society, indicates:

"To R. T. Pierce & Co., fruit package manufacturers, or to whom it may concern:—The undersigned fruitgrowers of South Haven, Casco, and vicinity hereby agree to use in the shipping and selling of peaches the full peck basket, and if a large package is required, then the bushel or an aliquot part thereof."

This agreement will give our South Haven friends a great advantage if—as they propose—the baskets are branded "full peck" and they sell a part of the crop at home. It is a broad notice and fair warning to package manufacturers. If legislation is necessary to compel the use of the aliquot parts of the dry measure bushel for fruit shipments, why not enact a law prohibiting the manufacture or offering for sale of the odd fractional parts of the bushel. Such a law would give us uniform size packages and prevent the continued pandering to the small side of human nature by the box and basket makers. They ought to do it without compulsion.

But the successful marketing of our fruits is of more importance than the size or style of packages. Should nothing occur to mar the present prospects, the prospective crop of peaches for the coming season in the lake shore counties of western Michigan will exceed five million baskets. Other tree fruits and small fruits will probably approximate to the net value of the peach crop.

Chicago commission houses will handle the bulk of this fruit under our present system of marketing. No other agency can supply the demand in that city, but a large part of the fruit consigned to Chicago is sold there to shippers or forwarded to other points by reshippers, who govern the prices. The daily supply is usually much larger than necessary to supply the city trade. The shipper "bears" the morning market and

makes the price of the early city trade. A few large receivers of consigned goods get the fruit from individual growers, who have established a reputation, and hold the goods for their regular city trade. The small receivers have their regular customers, but sell to shippers if possible, and all are often obliged to close out to peddlers and canners at prices barely sufficient to pay charges. In view of these conditions, can Michigan fruitgrowers devise methods by which their fruits may be widely distributed at less expense, a surplus utilized, and a better and more confidential understanding established between growers and dealers?

I can not assume to answer these questions in full detail, but allow me to suggest that the several fruitgrowing societies in western Michigan form business associations at their principal shipping points, with paid officials sufficient to grade and sell all fruit which can be sold at such points at fair prices. Ship in full car lots to points outside of Chicago, upon advice of your own agents at those places; utilize a surplus of inferior or "off" stock by canning or evaporating at home. Let each organization place a resident agent in Chicago whose duties shall be looking after the handling and delivery of fruits from their own locality, advising growers at 2 p. m. of each day by telegraph of the conditions and prospects of the markets, the dispatches to be printed in the afternoon paper or displayed upon bulletin boards. Let your agents be quiet, unobtrusive gentlemen, who will be *en rapport* with transportation officials and the leading commission men, and ready at all times to give them full information regarding immediate or future shipments. You will require a resident agent in Milwaukee and one in St. Paul and Minneapolis, who will give daily information to all the fruit exchanges in Michigan regarding the conditions and requirements of those markets. [As I have mentioned fruit exchanges, I wish to say in answer to many queries, that the Michigan Fruit Exchange is not dead; it was crushed by the ponderous weight of its management and the unrequited efforts of its executive board, but it still lives and only awaits the federation and co-operation of other societies to complete its resuscitation.]

If each locality preferred to act independent of others, it could be done; but the co-operation of the several executive boards to formulate business methods whereby unity of action will be facilitated will be of much importance, and the interchange of information by agents regarding the daily movement and placing of fruits will be indispensable. Agents should be paid by pro rata assessments on fruit shipments, and all commission rebates made to large consigners should recur pro rata to shippers.

I will not presume to make further suggestions; but believing that the time has arrived when more economical and comprehensive methods for marketing fruits are required by the large interests involved in fruitgrowing in Michigan, I leave the subject to younger hands and wiser heads.

Mr. Mead, of committee on packages, asked whether the society wanted the committee to understand that the society was going to use full quart packages.

Mr. Webster offered this resolution: "*Resolved*, That we use the full quart this year."

Mr. S. H. Comings spoke in favor of the resolution.

Mr. Woodruff said that he had for four years tried full quarts, but found that the shippers of "snide" packages got as much as he did.

S. Handy: I do not believe in passing a resolution that you do not intend to live up to. If a majority would use full quarts, I think it would be a good thing to do.

Mr. Van Brunt: To pass this resolution would be to step on the toes of the package manufacturers.

Mr. Webster: No other word expresses so much contempt as the word "snide." I am opposed to "snide" packages. There is too much "snide" in everything. We are getting to be a "snide" set. I am in favor of an honest package.

Mr. Pixley: If we pass this, what will you do with the "snide" packages now manufactured?

Mr. Morrill: There will be no trouble about getting full quart packages if you want them. Twenty-four hours' notice would be sufficient.

Mr. Woodruff: I hope you will pass this, and then I can buy the "snide" package for about half its cost.

Mr. Ruth: Unless a majority ship in full quarts the full quarts will simply help to sell the "snide" package, and you get not a cent more for it. The chief advantage is that in time of a glut the full quart will sell first. The full quart takes too much talk to sell it for any more than the "snide." A small shipper can not build up a reputation, whereas a large shipper may.

S. H. Comings: It takes years to build up a reputation, but it pays in the end.

W. A. Smith offered an amendment, to include the use of the peck basket for peaches instead of the fifth-bushel. He has no faith in an attempt to use the full quarts. The only way is to use the full quart and stamp it "full quart." The Delaware fruit exchange was broken up by growers who wanted to save one cent per basket by doing their own selling outside of the society.

Mr. Withey: The manufacturers are responsible for the "snide" packages. They reduced the size originally as an inducement for shippers to buy their packages. I am in favor of the peck basket and the full quart.

Mr. Morrill: If a grocer here were to sell fourteen ounces for a pound, and if you could buy sixteen ounces in St. Joseph, how long would you buy in Benton Harbor? How long would fruit-buyers buy small packages when they could get large ones? Mark your crates full measure, and do not change houses. I am satisfied there is money in the full measure and good packing.

S. H. Comings: I have found houses in Iowa who handle fruit by carloads. I think by combined efforts we could get the benefit of these distant markets.

Mr. Smith's amendment carried. The motion as amended was carried.

At the meeting of March 6 the society met at Grange hall, at 2:30 p. m.

Mr. Pixley said that an Ohio manufacturer of Climax baskets offered to furnish them at $33 per 1,000, here (very nice baskets), if 200,000 or more are contracted, to be delivered July 1. They make five, seven, eight and nine pound baskets; with smooth, flat covers.

Mr. Handy suggested that the question of raising cucumbers for the proposed new pickle factory be discussed. He said that parties had, at 40 cents per bushel (52 pounds), cleared $260 on 2½ acres. Little work is required, except in the picking.

A. Brunson: On suitable ground they are a good crop, but I do not think sandy soil is the best. Good ground might clear $300 per acre.

President Morrill: The Improvement Company have put up a large sum for new investments, and their success depends on getting new plants here. The pickle works want from 500 to 2,000 acres. They want five acres of land for their works, and expect to spend on improvement $25,000 by November next, $25,000 more in the next two years, and to employ 100 men nine months in the year to handle the crop. Mr. Morrill said that two or three years old cucumber seed is the more productive. The seeds are furnished by this company gratis. They take 50 pounds of cucumbers to the bushel.

Mr. Calkins said they should be picked half one day and half the next.

It was stated that it is uncertain whether the Alden canning factory is going to run this year.

Pres. MORRILL stated prices paid for tomatoes at other places, which were not so favorable as prices here. They can't afford to pay more.

Mr. HANDY would rather grow cucumbers at 40 cents per bushel than tomatoes at $8 per ton.

Mr. WEBSTER offered the following: "*Resolved*, That it is the sense of this meeting that it is the interest of the farmer to take some contracts with the pickle company.

S. H. COMINGS offered to amend: "Contracts sufficient to secure the location of the pickle company here."

Mr. WEBSTER accepted the amendment, which was carried.

Mr. WEBSTER said A. J. Merry is circulating a paper to agree to use full quart packages.

Mr. WATSON said that "snide" packages are sent to Chicago and there used for repacking.

Mr. HANDY said he knew of peaches being repacked there.

Mr. A. BRUNSON: In Missouri, New Yorkers ship in "snide" barrels (11 pecks.) A New Yorker told him the 11 peck barrel was used in New York, and not the three-bushel barrel.

Mr. COMINGS said that there is a good deal of repacking done in Chicago.

Mr. BRUNSON said that Mr. Hull ships a good many apples in three-bushel barrels to send west.

On March 13 the society met at Grange hall.

Mr. HANDY: In Chicago third-bushel boxes are repacked into peck baskets and the latter sold for $1 quicker than the third-bushel sold for 80 cents.

A. BRUNSON said DONNELLAN had cleared $350 on three acres of cucumbers.

Mr. MORRILL: The new company to locate here is to erect $25,000 worth of improvements by July 1, 1891.

Mr. HANDY said he would rather raise cucumbers at forty cents per bushel than tomatoes at ten dollars per ton.

Mr. MEAD of committee on packages, said that GEO. COMINGS had secured subscribers to sixty shares of stock in the new company.

The secretary stated that Mr. COLBY said that he would sell packages in the flat as low as any one else.

R. BRUNSON was in favor of patronizing the man who brings down the price of packages.

Mr. HANDY said he did not think Mr. COLBY would give us a figure unless we could get stuff somewhere else cheaper than the old prices here.

President MORRILL is in favor of patronizing home manufacturers. if they will deal as favorably as any outsiders.

Mr. A. A. SMITH said it was no use for us to go to them individually. If we can combine we can then get packages more favorably.

Mr. JUDSON thought that probably we can get crates lower this year on account of the unusual supply of blown-down timber.

S. COOK: They told me they had more timber on hand this year than ever before.

Mr. MORRILL stated that they had lately refused an order from out west for fifteen carloads of stuff in the flat.

W. A. BROWN: If you can get up a little competition between St. Joseph and Benton Harbor it may be a good thing.

Mr. EAMAN said Mr. PIXLEY thinks that if home organizations will do as well, buyers should give them the preference.

Mr. MORRILL: The business is to accumulate all the orders of the individual growers and place them where we can buy the cheapest. We first want to know the amount wanted, and the terms on which we want to buy.

W. A. SMITH read the subjoined paper on fungoid diseases of fruit trees:

There is a close similarity in many cases between diseases of animals and plants. It is becoming more and more apparent every year that many diseases in the animal economy can be traced to microbes, bacteria, or parasitic insects. It is now claimed with a good show of probability, that the dread pulmonary disease known as consumption, which it is claimed carries off 200,000 victims annually in this country, can be successfully treated by inoculation, which it is claimed destroys the microbes directly or indirectly by cutting off their food supply. There is probably not a single animal in the entire animal economy that is not more or less affected by parasitic insects. The same rule holds true in the vegetable kingdom. Here we find both the insect and the fungi parasite. These latter contain all the characteristics of plant life, save the root and foliage, neither of which are essential for their support, since they live and feed upon the juices of other plants. The presence of these parasites is by no means destructive of vegetable growth or life, unless their numbers become excessive or abnormal, which usually occurs when the conditions of healthy vegetable growth are in part cut off; as in case of severe and long continued drouth we find our tender vegetables, such as cabbage, turnips, etc., in a short time will become a living mass of aphides or plant lice; and the only way to successfully counteract these hosts is by promoting a vigorous, healthy vegetable growth.

The same is true of the aphides or bark lice on trees. They invariably attack those of low vitality, having been long neglected and stunted. Some of these parasites attach themselves to the body of the tree, and some attack the young and tender twigs, and by feeding upon the juices of the tree and twigs, keep them in a low condition.

From a collection in the British Museum, Francis Walker has described 326 distinct species of these insects, some oviparous, or egg producing, and some viviparous. In the spring the females alone make their appearance; the males come in the fall; consequently pairing in the spring can not take place. The female is self-fecundated, and multiplies with amazing rapidity. A single female may in her own lifetime be the progenitor of 6,000,000,000 of her species. They usually assume the color of the plant, twig, or tree upon which they feast, and are therefore liable to escape observation. Some years ago the orange trees of California became seriously affected with these scales. The orange groves were threatened with destruction, and no application for their removal proved effectual. A scientist versed in entomology was dispatched to Australia, where it was claimed the same insect was preying upon the orange trees of that country, and where it was supposed to emanate from, to study its life, habits, and character in the supposed home of its nativity. Upon arriving there he found but few of these scales on their trees. By a careful study and close observation he soon discovered a friendly parasite that did the work for them. He succeeded in collecting a number of these insects and transplanted them to California where they were liberated, and every condition being favorable they soon multiplied and did the work for them which the combined ingenuity of the horticulturists of this country could not do, and their trees were saved.

Among the many diseases incident to vegetable life and growth that the fruitgrower has to deal with may be mentioned the family of rusts, or fungi, that affect the strawberry, the raspberry and the blackberry. These fungi seem to affect some varieties more than others. They are also more destructive on some soils and in some seasons than others. About the only practical remedy is the removal of the affected plants, good culture, and occasional renewals. As a rule we do not renew often enough.

Powdery Mildew.—This disease affects many of our trees in the foliage, also vines, plants, and fruits. The plum, cherry, quince, apple, peach, and some deciduous plants and shrubs are affected by it. One can not easily mistake this fungi, for it has a white, velvety, powdery appearance. Grape vines and fruit are sometimes covered with it. This fungus seems to thrive even better in a dry, hot season than in a wet one.

Downy mildew, or leaf rust blight, affects many of our trees in the foliage, as well as the grape. The Delaware has been subject to this disease for many years. The leaves are covered with a rusty coat, and often drop long before the fruit is mature. The plum is very much subject to this leaf blight.

Any disease that destroys the foliage of our trees and vines virtually destroys the fruit and reduces the vitality of the tree and vine so as to enfeeble the same for the succeeding crop.

Dusting with sulphur and lime has been practiced for years with more or less success, but now spraying with the copper carbonates and ammonia is the remedy, or rather the preventive, for every species of fungi, whether on the foliage or on the fruit. The foliage of many other fruit trees is also affected by this fungi. The cracking of the pear is a fungus affection. The pear scab and the apple scab are caused by a microscopic vegetable fungi. This fungi, like every other species, is a vegetable parasite and feeds upon the juices of its host whatever that may be. The effects of this fungi are too apparent to the common observer to require any particular delineation here. The fruit thus affected is inferior in size and quality, being one-sided, as the fungi usually attacks one side, while the other side develops in its natural order. The Sekel pear is particularly subject to this fungi, and being small is often rendered nearly worthless thereby. Last year the Flemish Beauty was badly affected in the foliage by the fungi known as the rust leaf blight and shed its leaves prematurely. The fruit, too, what little there was, was generally cracked.

Some of the diseases that affect our trees are of such a mysterious character that we know neither the cause, the remedy, nor the preventive. Among these the peach yellows has baffled the ingenuity of man for a hundred years or more. It is as a dark mystery now as ever. One peculiarity of this disease is that the fruit is affected to all appearance simultaneously with the tree. The fruit generally shows the first symptoms of the disease by the discoloration of the skin and flesh, a spongy, often abnormal growth, and insipid flavor. These symptoms of disease not unfrequently occur in the fruit, while the tree has every appearance of a healthy, vigorous vitality. This is probably one of the incipient stages of the disease. The subsequent stages are manifested in the general sickly appearance of the tree, the yellow cast of the leaves, the want of vitality, and the small wiry shoots emanating from the branches and twigs of the tree. Another peculiar characteristic of this disease is, an attack of a tree in ever so mild or minute a form indicates the certain destruction of the tree. The affected fruit is insipid and worthless, and the life of the tree is only a question of two or three years at most. Whatever the cause may be, whether it is microbe, bacteria, or parasitic fungi, or whatever else, the only recommendation that can be made is to remove the tree as soon as the disease manifests itself (either in the fruit or the wood), root and branch, and destroy it by fire. By a microscopic examination of the roots of many diseased trees in Delaware a year or two ago by Mr. Smith, of the agricultural department at Washington, no indication of disease was found in the roots. They were to all appearance healthy. Whether science, art, or skill will ever divulge the cause, the remedy, or the preventive, is for the future to determine.

The plum and cherry trees are subject to disease known as the black-knot—the plum more so than the cherry and is affected more by it. This is doubtless caused by a fungus parasite that feeds upon the tender tissues of the wood and grows in knots and bulges on the body or limbs of the tree. It makes an unsightly appearance, and if allowed to run its course unchecked, will in a short time destroy the tree or render it worthless. No effectual remedy or preventive has yet been discovered. When trees are hopelessly affected the better way is to remove them root and top and burn them. When not too much affected the diseased parts may be pared off, cut out, and burned, and the wound coated over with linseed oil or a mixture of linseed and kerosene oils.

The fruit of both the plum and the cherry is subject to the fungus disease known as black rot, similar to the black rot on the grape. This and the fungoid leaf rust, so fatal to the plum, may at least partly be prevented by the timely application of the copper carbonate and ammonia fungicide. To be effectual for the plum this applicaaion should be made early, as soon as the foliage is ready to open, and every three weeks thereafter. Fungoid spores are maturing and are dissemina'ed from tree to tree through the summer. The black-knot does not affect the fruit, only as it affects the vitality and vigor of the tree. As the plum will require about the same number of applications of the fungicide as of the insecticide, the two may be mixed and applied at the same time, thus destroying the curculio and preventing the rot. If these two enemies of the plum and cherry, curculio and rot, can be successfully combatted, I see no reason why these fruits can not be profitably grown any where in this country.

The grape is subject to various diseases, among which the downy and powdery mildew and the black rot are conspicuous. These are all of the fungoid family, and where they largely prevail a preventive must be applied in order to save the crop, as a remedy or cure is out of the question. When the fungus spores have once established themselves on the fruit no application can remove them. As this fungi may, and probably will, attack the foliage before the fruit is set on the vines, it will be necessary to apply the fungicide as soon as the leaf buds are fairly formed, again when in full leaf, and again when in bloom or shortly after, and once or twice after the fruit has set. The

number of applications might in a great measure depend upon the probable amount of rot that is likely to develop, which may be judged from previous years, and also from the state and condition of the weather. Frequent showers soon after spraying wash the solution from the vines and fruit and make a repetition necessary. When the rot is once established in the vineyard, the only remedy then is hand picking the affected berries or specimens and destroying them. Where the fruit is much affected this is a tedious and laborious task, and even if well done leaves the fruit in an imperfect and unmarketable condition. The downy mildew, or leaf rust blight, has affected the foliage of the Delaware grape for many years, and often destroyed the crop by the premature shedding of the leaves.

Fire blight of the pear.—This disease may be said to be peculiar to the pear, as yellows is to the peach, and the cause of the one is about as great a mystery as the other. It is claimed by scientists that the microscope will reveal microbes, bacteria, or parasitic fungi in the diseased wood of the blighted tree; but whether this fungus is the cause or the effect of the changed condition in the sap of the tree, is a question that is not fully established. Neither is there any known remedy or preventive; remedy there could not be, since the tree or parts of the tree affected by the disease are absolutely dead when we first see it. In a few days the tree passes from an apparently healthy, vigorous state to a partial or utter prostration. The parts affected shrink and discolor, the leaves turn black but do not drop, and the fruit, if any, shrinks and shrivels up. Whether the disease is communicated from tree to tree by fungus spores or some other agency, it is evident that the parts affected are dead and only an encumbrance upon the remaining healthy parts of the tree, and should therefore be removed as soon as convenient, by cutting back from the affected parts five or six inches and destroying by fire. In this way trees that are not too badly affected may be preserved for years and continue to bear profitable crops. A very general impression prevails that pear trees, standing in sod and neglected, are not subject to blight; but this is a fatal mistake; they do blight, and I think fully as often as those that are cultivated; what is worse, they bear no fruit worth naming. No doubt many young pear orchards are ruined by over-bearing. The trees becoming enfeebled and exhausted become an easy prey to the destroying blight. Where fruit trees are allowed to stand in sod without cultivation they may be made highly productive by heavy and thorough mulching to prevent the tree being robbed of moisture and nourishment during the growing and fruiting season. Otherwise good culture should be the rule with an occasional application of ashes or bone meal, or both.

The apple is king among fruits, and as such demands our best efforts for its preservation and improvement. While the apple is pre-eminently the king of all fruits, and the tree is among the most hardy, vigorous, productive, and widely disseminated of all our large fruits, it is not without its enemies and diseases. There are insects, parasitic and others, that prey upon it, and various fungi that feed upon the foliage and fruit. The twig blight, though not common, sometimes affects our apple trees. The quince is more commonly affected in this way than the apple. The twig blight seems more like the work of an insect than a fungi. Next to the codlin moth and apple maggot insects, the apple has no more serious nor destructive enemy than the fungi known as the apple scab. It is a peculiar circumstance, at least in many locations, that certain varieties of apple are far more affected by scab than others. With us the Early Harvest, Yellow Bellflower, Red Canada, and Spy are particularly subject to scab. The amount of drainage and loss sustained by the orchardist in consequence of scabby fruit is almost beyond our calculation; 75 per cent. or more of the entire crop is affected more or less by this fungi. A large proportion is rendered fit only for cider, and in many cases not 10 per cent is entirely free; and only those that are free will pass for strictly No. 1 fruit.

The insect enemies of our fruits we have been fighting for years, and latterly with good results. It now behooves us to look after the fungi. Of these there are more than 50 distinct species preying upon our fruits; but, being so nearly allied in general characteristics, one to the other, the same application of fungicide will be effectual in most cases. The scab is a fungus, a true vegetable growth, that feeds upon the juices of the apple and thus prevents a full and complete development of the fruit. These fungi grow, mature, and send out innumerable spores, which, falling upon other specimens, take root when the conditions are favorable. When these spores have once fastened themselves upon the fruit and sent their feeders through the epidermis or outer covering of the fruit, no application of fungicide will be available. The application must be a preventive and not a remedy, and must therefore be used before the fungi makes its appearance. Upon this, as on many other subjects, we are almost entirely dependent upon our experimental stations for critical and accurate results. They have already accomplished a grand work for the farmers and horticulturists of the country.

Spraying for the apple scab at the experimental station, at the Agricultural college of Michigan, in 1888, five different solutions were used. Two of these only gave good results, viz., the copper sulphate and copper carbonate and ammonia. These experiments were applied upon a certain number of "Spy" trees from the 24th of May to the 1st of August, seven applications in all. Of these two solutions the one known as "modified eau celeste" gave the best results. In this case 70 per cent. of the fruit was free from scab, while the next best saved 53 per cent., and the unsprayed trees showed only 15 per cent. of sound fruit. These experiments were conducted by Prof. Taft, of the station, with the following solution, viz., copper carbonate 3 oz, ammonia 1 qt., water 22 gal.—This was the 70 per cent. From certain indications of the foliage the Professor concluded that the solution was too strong and recommended the use of 32 gallons of water, instead of 22. Prof. Fairchild, of the Department of Vegetable Pathology at Washington, in an address delivered before the Western New York Horticultural society, at Rochester this winter, on the fungi diseases of fruit, recommended a formula nearly identical in proportions with that of Prof. Taft, viz., 5 oz. of copper carbonate dissolved in three pints of the strongest water of ammonia, 20 per cent., and diluted with 50 gallons of water. By using a common kerosene barrel, holding about 50 gallons, this formula will be a convenient one for practical use in our orchards and vineyards. Cost of the compound:

Copper carbonate, 5 oz.	$0 18¾
Ammonia, 3 pints	0 52½
Water, 50 gallons	0 00
Total	$0 71¼

This is the estimate of cost when the materials are procured in a small way. If purchased in bulk, the cost would be considerable less; perhaps 25 or 40 per cent. This formula, although specially recommended for the fungi affecting the apple and grape, would doubtless prove efficacious for the plum and cherry rot and fungi generally.

The time of application is an important consideration and upon which may depend success or failure. The experiments at the station were commenced, as before stated, on the 24th day of May, two days after the trees had been sprayed for the codlin moth, and ended on the 1st of August, seven applications in all. If the season is favorable, not too showery, Prof. Taft thinks three applications would be sufficient, and in one or two of these applications the London purple or Paris green insecticide may be added, thus reducing the time and labor of two applications to one. In the formula for the 50 gallons, 3 to 4 ounces of London purple should be used; 3 ounces would be safer than 4. We can not too strongly recommend the general use of these insecticides and fungicides. These insects and fungi, if not checked in their onward march of destruction by a general warfare, will sooner or later render all our efforts in horticulture abortive.

After the paper, Mr. Smith said that we must experiment about mixing together insecticides and fungicides, as it had not been practically tested.

Mr. Cook spoke of an experimenter who suspended plates of polished steel above the ground. The next morning he found fungi on the under side of the plates, which showed that they had passed up from the ground. The theory is that they rise from the ground and find lodgment on the fruit and grow. It depends upon moisture and stillness of atmosphere. I have found it on peaches on low ground, while on high ground, where there was a current of air, there was no fungus disease. Moist, still, warm weather is unfavorable. I have known it to stop on a change of weather. Cooler and windy weather is favorable. The ground should be turned under with the plow. It is worse on trees standing in grass.

Mr. W. A. Brown: We should plant only the varieties least subject to disease. Some of our best apples are rendered almost worthless by apple scab, and so with pears. White Doyenné, formerly fair, became worthless by scab.

Mr. S. H. Comings: No doubt the source of contagion is in fallen fruit. We sometimes see an apple with one side shriveled up and the other side apparently sound. It is a mysterious thing and requires deep study. We were told long ago that the time will come when we shall have dominion

over all things, and I believe the time will come when we shall overcome these besetments.

Mr. COOK had burnt sulphur under a plum tree, and curculio did not touch it for a long time afterward, and thinks we ought to experiment.

ORIN BROWN smoked two Lombard plum trees with coal tar, and had good success. Cherries in same ground were ruined; the cherries were not smoked.

Mr. MORRILL: We should keep experimenting, and every man ought to take care of his own rot, etc.

Mr. A. BRUNSON: I do not agree that spraying to be effectual must be universal. Where I have sprayed, and not sprayed, the effect is very marked.

Mr. MORRILL: Where spraying is universal, certainly we are not raising so many codlin moths for next year.

Mr. S. COOK: The codlin moth flies, and the first generation does not destroy the whole crop of fruit.

W. A. BROWN: The later broods do not travel far.

Mr. WITHEY asked about grape rot.

A. J. MERRY had picked off rotten grapes. All in his neighborhood expect to spray next season. One of his vineyards rotted worse than the other.

Mr. WITHEY: Wherever it starts in a vineyard you will see it increase from year to year.

Mr. MEAD visited Mr. Crittenden's vineyard last year. Mr. Crittenden had not much rot. He thinks it pays to pick off rotten grapes, and he also sprayed.

Mr. FOSTER had some rot and paid no attention to it, and saw no more of it for several years, and now it nas appeared again.

Mr. S. H. COMINGS: My neighbor, who renews and cuts off old vines, is nearly free from black rot and mildew.

Mr. A. BRUNSON: You must watch the weather for spraying, and there is not over a week that is suitable.

Mr. PHELPS thinks spraying in hot sun is injurious to foliage.

Mr. GEO. COMINGS spoke about the new organization for procuring crates, etc., and said about seventy shares were now taken; that they had a definite proposition from a distance for crates in the flat.

Mr. MORRILL asked would it not be well to ask rates from home manufacturers as well as those abroad?

S. HANDY: They have combined against us, and I say, show them no mercy.

W. A. BROWN said he was glad this organization had made a start in this direction. He thought that in a short time stock for crates must come from a distance, and prices will go up unless some such movement as this is made a success.

On March 20 the society met at Grange hall.

Mr. GEO. COMINGS read a paper for Mr. S. H. COMINGS on "Transportation and advisability of sending a man to Chicago to look after our fruit interests," after which Mr. GEO. COMINGS reported that a number of Stevensville fruitgrowers had subscribed to the stock of the new company. Eighty-nine shares are now subscribed and they fully expect to be in shape to furnish packages when the season arrives. He hoped the new boat would be sustained, and said that much loss had occurred last year by reason of delay in getting our fruit to Chicago.

Mr. HANDY asked why we should sustain a new boat company unless they agreed to carry for less price than the old?

Mr. W. A. SMITH: Before a competing boat came here the old company charged five cents for eight-pound packages. The steamer saved this community thousands of dollars. There is business here for two lines of boats, and it is to our interest to keep up competing lines.

Mr. SMITH moved that a standing committee of three be appointed to examine into the question of transportation and rates of freight.

S. H. COMINGS: While we pay five cents per package, they were getting from the Hudson for two cents and from California (eight pound packages of grapes) five cents, which looks unreasonable.

Mr. SMITH: I don't think there is any way to prevent their selling out, except for the shippers to own an interest in the boat.

Mr. WEBSTER: We have been growing poorer and poorer because we have allowed all parties to impose upon us. Fruitgrowers ought to partly own and ought to control a boat.

The Secretary: One advantage in the new line is that it will deliver its Benton Harbor freight in Chicago the soonest and have it in time for the earliest out-going shipments from Chicago. Whereas Benton Harbor freight, by the old line, has all the St. Joseph and up-river freight piled in front of it; also that two docks in Chicago can handle the fruit better than one.

Mr. GEO. COMINGS said that a Chicago commission man advised to keep up competing lines and not have our fruit all put upon one dock in Chicago. The motion was carried.

The Chair appointed as such committee W. A. SMITH, A. J. MERRY, and S. H. COMINGS.

Mr. MEAD: I once thought that water transportation ought to make cheap freights, but we have been charged exhorbitant rates simply because we would pay them. It is impossible for one dock to properly handle all of our fruit in Chicago. There is business enough here for competing lines and it is our interest to sustain both lines.

Mr. SMITH: The right way to ship to the northwest is to ship in through cars, and there will be no trouble in getting cars when needed.

Mr. WATSON: At Fennville and Douglas, sometimes they could not get cars enough and the fruit would be left, so that we have some advantages here. I have known freight on apples to be advanced by the old line from ten cents to fifteen cents. The old line has no trouble about handling the fruit in Chicago, for if there is not room enough there they can bring it back here as ballast.

Mr. GATES read a paper on the codlin moth and entrapping it with a light at night.

On March 27, the society met at Grange hall. Mr. GOLDSMITH, of the Squire Dingee Pickle Co., was present and made a statement. He said that their paid-up capital was $150,000. They expect to open an establishment here, and to expend $25,000 to $30,000 in fixtures, and are desirous of securing contracts for 1,000 to 2,000 acres of cucumbers.

Mr. BROWN said indications are that a large acreage will be contracted about Stevensville.

Mr. JUDSON read a paper on the practicability of having an agent in Chicago to look after our fruit interests.

Mr. S. H. COMINGS said he was skeptical about an agent being able to

save as much on drayage as Mr. JUDSON figures out. He thought an agent could be of advantage to us in the northwest.

Mr. W. A. BROWN thought much can be done by an agent in looking up mistakes in the northwest, to travel and visit different towns and find markets. We should ship through without breaking bulk. We expect five to six million baskets of peaches, if nothing happens, and they will be all needed. Our agent should be able to give us information about markets at any hour.

Mr. S. H. COMINGS thought the new company to be organized tomorrow may be able to do much for its members—not only in buying packages but in freights and other items.

Mr. WEBSTER: Would make Benton Harbor and not Chicago, the distributing point for the northwest, and let buyers come here.

Mr. MEAD: Small fruit must be disposed of quickly, and if buyers do not come here we must ship to Chicago. I think this new company is a right move.

Mr. WEBSTER: My ticket is—a market in Benton Harbor; but if you are going to ship to Chicago, send a man there to look after it and restrict the number of commission houses we ship to. We have been studying how to raise fruit, and now we are trying to find out how to dispose of it.

Mr. W. A. BROWN: Sooner or later, our fruit must be sold here in Benton Harbor. The tendency in this direction is growing every year. The new organization is a good move, but they have much to learn. A great deal of missionary work has got to be done.

Mr. HANDY: One objection to selling here is that buyers make no discrimination between good and poor fruit.

S. H. COMINGS: The commission man is a good agent if he is the right kind of a man, and can do us much good.

Mr. FARNUM, in answer to a question, said that cars bringing fruit from the east would otherwise come back empty, and therefore they can afford to bring fruit cheaply. He said that he had never said that our lake freight was too high. He had thought that if fruit could be delivered in Chicago in good condition, it would result in a gain to us of fifty cents per case.

Mr. GATES read a protest against the report of his paper, read at the last meeting, as published, and wished the statement corrected, that he advocated trapping codlin moths with a lantern, and explained that his plan was to destroy them with an open light. He objected to the statement that Prof. COOK said that moths are not attracted by a light, which was a typographical error, and which should have read codlin moths.

April 3, 1891, the society met at Grange hall.

Mr. PIXLEY, of committee on packages, said that their new organization was about closing contracts for crate stuff, and were anxious to know whether the shippers want the full-quart package or the "snides." Mr. PIXLEY favored full standard packages. The association is known as the Berrien County Fruitgrowers Co-operative association.

Mr. HANDY thought the majority of shippers would ship in small-quart packages, though he would prefer the full-quart package, if three fourths of the shippers would use them.

S. H. COMINGS thought that it would take a good while to settle this question of size of packages.

Mr. PIXLEY thought that it was a question of morality.

Mr. HANDY thought that it was more a question of dollars and cents than of morals.

M. S. COOK approved of full-quart packages, although he had seen his neighbors get as much for "snide" packages as he did for standard packages.

Mr. J. H. WATSON was in favor of using full-size packages, although he had received just as much for "snide" packages as he did for standard packages.

In the absence of R. BRUNSON, the secretary read Mr. BRUNSON'S paper on "What Small Fruits Shall we Plant?"

Mr. WEBSTER asked about strawberries.

Mr. MORRILL: Lady Rusk is very hardy and frost proof, but grows in poor shape.

Mr. WEBSTER: Sharpless is as good as any, if the location is favorable.

Mr. COOK: Cumberland is more productive with me than Sharpless.

Mr. WEBSTER: I am satisfied that for the Fair Plain neighborhood the Warfield is best.

Mr. WATSON: It is a great plant-maker.

Mr. MORRILL: The Warfield must be kept close in. I would set every fifth row as a fertilizer.

Mr. WATSON: I shall use Michel's Early to fertilize the Warfield.

Mr. HANDY: A field set one half to Sharpless and one half to Crescent produces as fine Crescents at the extreme end as it does where it joins the Sharpless.

W. A. SMITH read a paper on "Standard Fruits—What to Plant," after which Mr. SMITH said that he had not been troubled with the falling of the plum leaf since he commenced spraying; that the Iowa experiment station mixes milk of lime with poisons and sprays plums successfully, although used ten times as strong.

Of apples, Mr. SMITH advised setting the Oldenburg, Red Astrachan, and Sweet Bough for summer fruit, the Maiden Blush for fall, and the Baldwin for winter. His favorite pears were the Bartlett, Flemish Beauty, Sheldon, Anjou, Clapp's Favorite, Angouleme, and Seckel. In Mr. SMITH'S opinion, based on experience, all the earlier varieties of peach should be abandoned, for the reason that they are inclined to cling, are subject to rot, inferior in size and quality, and come into competition with better fruit from other localities. Among the older varieties, the only early peach worthy a place in our orchards is the Early Rivers. There is hope of a new early peach—the Mountain Rose—from Mr. BROWN'S propagation. Of the later varieties, the Oldmixon, Stump, Crawford, Foster, etc., are standard. The Beers Smock is also a good late peach. Mr. SMITH thought there was no longer any reason why plums could not be grown successfully, since spraying had been introduced with such good results. He thought no other department of pomology would give better satisfaction than this if properly conducted. The same remarks applied to cherries, the propagation of which is now almost entirely overlooked. Of the varieties of plum and cherry best to plant, growers would do well to consult those who have made the growing of these fruits a success.

Mr. RUFUS BRUNSON read a well prepared paper on "The best kinds of small fruits to plant this spring," giving his own experience in the culture of several varieties. Mr. BRUNSON did not recommend the extensive growing of small fruits, as he thought it more profitable and satisfactory to raise peaches, pears, etc. In setting blackberries, he recommended the Wilson

and Lawton for high ground of a gravely or sandy nature, and the Snyder, Kittatiny, or Lawton for low, wet ground that had been properly drained. In raspberries, the Gregg seems to be the favorite; but there are many other varieties claiming superiority to it—among them the Lovett, Nemaha, Pioneer, and others. For a red raspberry, Mr. BRUNSON knew of nothing better than the Cuthbert. In currants, Red Dutch, Fay, Victoria, and Cherry seem to take the lead, more of the former having been set here than of any other variety. In speaking of strawberries, Mr. BRUNSON said that so many good varieties had sprung up that he was at a loss to know just what sorts were the best. For a berry that will stand a long shipment he recommended the Warfield, and for the Chicago or other near market, the Sharpless, Haverland, Parker Earle, and other similar varieties.

Dec. 22, 1891, the society met at G. A. R. hall. The annual election of officers resulted as follows:

President, R. MORRILL; 1st vice president, W. A. SMITH; 2d, R. C. THAYER; 3d, N. L. KANE; 4th, S. G. ANTISDALE; 5th, L. N. RUTH; secretary and treasurer, A. J. KNISELY.

Mr. MORRILL read a paper on "How can we as horticulturists derive the greatest benefit from the Columbian Exposition?"

R. C. THAYER said no doubt people all over the world are asking themselves how they can derive the most benefit from this great exposition; he was much pleased with Mr. MORRILL's paper.

Mr. S. COOK: A noted eastern fruitgrower, recently, in speaking of localities where peaches are raised, left Michigan out. I hope that man will come out here.

Mr. MERRY was pleased with Mr. MORRILL's paper; no doubt we shall be much educated by the fair. As to the money feature, people have no idea of the extent of our fruit belt.

Mr. W. L. KANE: Our State society has asked for 5.000 feet of space in Horticultural hall and two acres of ground outside.

LENAWEE HORTICULTURAL SOCIETY.

OFFICERS FOR 1892.

President—D. G. EDMISTON.
Vice-President—F. J. HOUGH.
Secretary—E. W. ALLIS.
Treasurer—B. I. LAING.
Executive Committee—H. C. BRADISH, C. H. BRADISH, A. SIGLER, Mrs. M. S. TRINE, Mrs. E. P. CRITTENDEN.

The following is the President's report of the year ending Dec. 31, 1891:

According to the usual custom, at the expiration of a term of office held by the president of this society, I present a review of the doings of the society for the past year. We have had during the year an average good attendance, and, as usual, great interest has been manifested in the subjects under discussion, which have been taken up in the order of fruits coming to maturity in each month.

Owing to an almost total failure of perfectly grown or sound apples, the display, both in our own society and in competing with other societies at the state fair, and also at the Detroit exposition, was but partially carried out or not attempted at all.

The display at our monthly meetings, of small fruits, with the exception of grapes, has been very good, better than was anticipated after the early frosts.

We have had an accession of many new members during the year, who, by their presence and interest in taking part in the various discussions, have been a great help and aid to the society. We have also been entertained, by kind friends, with song and recitation, at different meetings.

The January meeting, held at the ladies' temperance parlors, was a very successful and instructive one. The first matter of importance was the report of a committee which, after persevering and persistent efforts with the proper authorities, reported that the board of supervisors made an appropriation to furnish a permanent "hall" and rooms in the basement of the court-house, for the free use of the society, and other purposes. A paper was read by Dr. OWEN, on "Fertilizers for the orchard,"—one of the best of the year. Who of us then thought we were listening to his last effort; that his cheerful smile and pleasant words would so soon go out from among us forever? An active discussion followed his paper, participated in by Messrs. HOLDEN, OWEN, SHEFFIELD, EDMISTON, BRADISH, ALLIS, LAING, COLLER, GIBBS, and others.

The February meeting was also held at ladies' temperance parlors. The forenoon was devoted to the transaction of business concerning our new rooms to be occupied in the near future, and other business. After dinner, a recitation, and then the regular programme was taken up, led by a well-written article on "House plants" by Miss HELEN NICKERSON. Discussion followed, participated in by both ladies and gentlemen. Then followed a recitation by MARY C. ALLIS, "May Belle." The second topic was "The preparation of soil for crops," which finished the discussions for the day. It will be impossible for me to take up in full the events of each subsequent meeting, and I will only glance at the more prominent events.

Our March meeting opened at our new hall in the court-house. The forenoon session was mainly devoted to business pertaining to furnishing the dining room with tables, seats, and other conveniences, and to congratulations in securing rooms so well adapted to our purpose. The afternoon session opened with large attendance, and a few new names were added to our roll. After the reading of the minutes, a paper was read by D. G. EDMISTON, on small fruit culture, which met with hearty approval and it was decided that the paper be offered for publication.

The second Wednesday in April found us fully established in our new rooms, "Horticultural hall," which is well lighted and warmed and plentifully supplied with chairs and tables, and with dining room attached, making a cosy place for our eminently social meetings. The meeting in the afternoon was well attended and a lively interest manifested in the questions, "The proper growth and nurture of small fruits," "Gooseberries," "How to trim currant bushes," etc. Here my pen falters, for how well we remember this last visit, though a short one, paid us on that afternoon by Dr. OWEN. Before another week was done, he had folded his mantle

around him, and laid down to pleasant dreams. The shock of his awakening came not to him, only to those who were wont to meet him here in pleasant converse. His eulogy, pronounced by one who knew him well, was a touching tribute to his memory Associated with this society from its very beginning, and for nearly all the time holding the office of librarian, it was fitting that we offered a tribute of respect to his name and his deeds. A floral offering was procured, and was one of the many offerings resting at his feet.

The May meeting was solemnized by tributes of respect paid to the memory of Dr. W. Owen and resolutions of condolence sent to his family. As we turn away from this scene we are reminded of old, staunch friends still laboring with us, who have helped and are still helping to make this society what it is, and who were its founders, Messrs. STEERE, SIGLER, HELME, HOUGH, SHEFFIELD, COLLAR, and STEBBINS, and possibly others. Among those who joined the ranks of workers in middle or later years are such names as LAING, STRONG, C. H. and H. C. BRADISH, E. P. and E. W. ALLIS, EDMISTON, WOOLSEY, GIBBS. GUSTIN, WOODWARD, and a large number of others who are not so well known, perhaps, in the horticultural world, besides a large number of ladies who take part in the deliberations and are a power in the social attractions. The subjects for discussion in the forenoon session were upon fruit prospects and the recent cold wave and kindred topics. After dinner, Mrs LAING gave a select reading and Miss ELLA EDMISTON a recitation. Mr. B. W. STEERE had a very creditable exhibit of fruit, also wild and cultivated flowers. The question box was opened and questions discussed. It was decided to hold a strawberry and flower show at the next meeting, and subjects for discussion were selected.

At our June meeting, held at the residence of Mr. and Mrs. SIGLER, we we were greeted by a fine display of roses and June flowers and a generous display of strawberries, considering that the earlier varieties, with one or two exceptions, were much injured by the frost. The afternoon session was very largely attended and many strangers were present, and a number of names added to our roll. A recitation was given by Miss EDMISTON. The topic for discussion was then taken up, " Deep or shallow cultivation of orchards," also the subject of small fruits. The answering of questions and appointing of topics for next meeting closed this very enjoyable day.

In our July meeting, held at Horticultural hall, several subjects were discussed at length. " The nature of rust on small fruit plants," " The spontaneous growth of plants," and " Wheat versus chess." The ladies took active part in discussing "The best variety of strawberry for canning" and " What is the cause of jelly candying?" There was also a fine display of flowers and fruits, notable among them a primrose by Mr. STEERE and three largest varieties of gooseberry of the season by Mr. JAMES KIRK.

Our meeting in August was held on the grounds of Mr. and Mrs. WESTERMAN, and as the day was propitious we came to order under the shade of beautiful trees. After transacting the ordinary business of the meeting, we listened to a recitation by Miss NICKERSON. The first topic was then

taken up, "How often should growing plants or crops be cultivated to benefit both soil and crops?" The subject was ably discussed and listened to by many friends from the city. Our regular social picnic dinner was held also in the grove and enjoyed by many invited guests. The after-dinner session was largely attended by friends from both near and far, adding more names to our roll. After listening to a fine recitation by Mrs. KNIGHT, the regular topics chosen for the day were ably discussed.

Our September meeting was held in Madison, at the residence of Mr. and Mrs. GUSTIN. The president not being able to be present, the meeting was called to order by Vice-President SHEFFIELD. The forenoon discussion on "Spring and fall planting of fruit trees" was then disposed of, and a viewing committee appointed to inspect the nursery grounds of our hosts. Then came dinner, which was rendered more pleasant by the hearty greetings to a former and honored member of our society, Mr. S. B. MANN of Glenwood, Florida, who gave us a talk during the afternoon session on "Oranges and the fruits of Florida." He also gave a few pointers in regard to making out good, clear reports for newspaper publication, telling by his own experience how they are appreciated by friends at a distance, whose hearts are warmed up as each old, familiar name is mentioned and the new names are accepted and loved as a part of the brotherhood. The interest in our own community is increased, resulting both in new memberships and the desire to raise nicer varieties of fruits and flowers, thereby bringing greater happiness to our homes. The committee on grounds reported a large quantity of nursery stock, consisting of apples, pears, peaches, plums, and other fruits, all in high state of cultivation, and which received high encomiums from the viewing committee.

The October meeting was held in Madison, at the residence of N. F. NICKERSON. The forenoon being very stormy, it was feared there would be a small attendance, but by the time the dinner was over, the weather clearing somewhat, there was a large attendance, as there invariably is when the society is invited to private houses. An able paper was read during the afternoon session, by J. W. WOOLSEY, on "Shade and fruit trees along the roadside, around the farm, and in the door-yard," calling forth a lively discussion; after which we listened to a very funny recitation by Mrs. GEO. KNIGHT.

The November meeting was held at Horticultural hall, and was well attended. Our dinner, partaking somewhat of the nature of a Thanksgiving feast, was highly appreciated. The after-dinner session was opened by a Thanksgiving recitation by Miss MARY C. ALLIS, after which came topic and discussion, followed by another recitation by Miss HELEN NICKERSON. The next, and final, meeting of the society for the year, was appointed to be held at Horticultural hall, for the purpose of electing new officers.

Of eminent services rendered to the horticulture of the country during the past year, Lenawee begs leave to contribute here a share. Mr. H. C. BRADISH has shown, for several years past, that grapes that are especially subject to mildew may be successfully raised by spreading and thinning the branches and rearing them in an open place, to give a free circulation of air.

Mr. KIRK of Adrian has applied the same principle to the English gooseberry, and Crown Bob and other varieties which this society tested and abandoned nearly forty years ago, were upon exhibition at our July meeting, and many quarts were sold at good prices in the city. The society has been invited to four places during the summer, and entertained by all royally. During the remainder of the year, we have met at Horticultural hall, and have had full attendance and good interest. During the last quarter of the year there has been more new members added to our number than during the same months of any previous year, showing no abatement in the general interest. The only trouble with this society is that when it gets to going it don't know when to stop.

And now, taking leave of you as president, I thank you all for the courtesy shown me.

MRS. M. S. TRINE.

OCEANA COUNTY HORTICULTURAL SOCIETY.

OFFICERS FOR 1892.

President—A. A. ADAMS.
Vice President—E. H. HOTCHKISS.
Secretary—BENTON GEBHART.
Treasurer—WM. H. BARRY.

The above officers, with C. F. HALE and WM. E. MERRILL, constitute the executive board.

The number of meetings held during the year were eight, which were generally well attended, with interest and profit to members. The number of papers read for discussion at said meetings were eight, as follows: "Failure and mistakes in small fruit culture," by BENTON GEBHART; "Nursery trees and orchard fruits," by H. ANTHONY; "Successful plum culture," by WM. D. MARKHAM; "Successful small fruit culture," by B. GEBHART; "The future fruit package," by E. H HOTCHKISS; "Needs of fruitgrowers for better distribution of their fruit," by AMASA ADAMS; "Lower rates and faster time by transportation companies," by C. A. HAWLEY; "Larger fruit and how to raise it," by I. H. FORD.

I herewith give the principal points in fruit culture which were discussed at these meetings In the discussion of the black knot on the plum, the question was asked when the disease of black-knot would first show its appearance on trees. Answered, that in June and sometimes in August and September.

A member asked if it was profitable to grow the blackberry and raspberry for market. WM. BAILEY thought if it was profitable to grow them at Benton Harbor, it certainly ought to be here, as the soil and everything was especially adapted to small fruit culture.

WM. E. MERRILL thinks there is money in growing small fruits. If the fruit does not pay to market in its green state, it can be evaporated with profit. Also, any one can create quite a home market in our small towns, with choice fruit.

A grower asked for the best varieties of raspberry to grow. Mr. MERRILL said, if a black-cap for market, plant the Gregg; and would also recommend the Tyler and Ohio for early and prolific bearing. For the best red varieties, the Cuthbert is at the head. B. GEBHART would plant, for the best black-cap, the Tyler, Palmer, Johnston Sweet, and Nemaha; for the red, for market, Marlboro, Cuthbert, and Shaffer, the latter being the best of all for growth of cane, productiveness, and fine quality.

The question of pear blight was somewhat discussed, and while all growers regarded it as a very disastrous disease, it would still pay to plant pears. H. ANTHONY said the blight was periodical, that in the great fruit sections east it would come in certain years and wipe out their pear trees and then disappear again for years. It still was a mystery. Some varieties, such as Clapp's Favorite, Sheldon, and Flemish Beauty, are more subject to the blight than are others.

W. S. GEBHART, in speaking of varieties that are claimed to be blight-proof, had had the Anjou and Kieffer on young trees blight to the ground.

Question: Should young peach trees be headed in, and how much, and when to do it properly? A. ADAMS said to head in early in the spring, just before the leaves start; cut back new growth on one-year trees, leaving it from four to six inches long, and continue to cut back heavy growths on two and three-year-old trees each year; that by so doing it would make the tree more stocky and uniform in shape.

A question was asked as to the best tool or cultivator to use in a peach orchard early in the spring. C. A. HAWLEY thought the best tool was the gang-plow, followed by spring-tooth harrow and cultivator not later than August 1 or 15.

E. S. PALMITER asked what to do to drive off or destroy black ants on cherry and plum trees, they being so numerous as to injure his trees.

B. GEBHART thought it was not the ants that did the damage, but the green and black aphis, and the juice of the leaves attracted the ants.

B. GEBHART thinks quince culture to be profitable if the trees receive good culture and are well fertilized. He would recommend Rea's Mammoth and Champion, although the latter is rather late.

W. S. GEBHART fears no trouble in growing the Champion, as it ripens nearly every season with him. H. ANTHONY thinks that a few quinces will supply the market and would plant the Orange. C. F. HALE thinks it would pay to grow the quince and would plant the Orange quince for market.

A paper on plum culture by Mr. MARKHAM, giving his experience and mode of successful plum culture, was very instructive to new beginners in the business and was well received. He would plant the Lombard for profit.

The subject of propagating plum on peach roots had a spirited discussion, many believing, and knowing it to be a fact, that certain varieties did best on peach roots in our sandy soil.

B. GEBHART said that from his experience only certain varieties would do well on the peach. Such as Lombard, McLaughlin, etc., would not unite in the wood. Bud or graft one and two-year-old peach seedlings.

A paper by E. H. HOTCHKISS, on the future fruit package, was well written, stating that the best and most profitable package for growers to use was a package of full measure such as the one-quarter bushel, one-half bushel and bushel basket.

Some large growers spoke favorably of a full or standard measure, to be

established in our markets, and growers could realize more for their fruit. A few leading growers spoke very highly of the fifth bushel or climax basket.

E. H. HOTCHKISS said it was the wish of many commission men that we ship more fruit in one-half bushel and one-bushel baskets for the use of wholesale trade.

WM. MARKHAM said fifth climax baskets were the best baskets made to ship our choice fruit in.

A. ADAMS with others said, put extra or choice fruit in the fifths, and lower grades of fruit in one-half bushel and bushel baskets, to get best returns.

SOUTH HAVEN AND CASCO POMOLOGICAL SOCIETY.

OFFICERS FOR THE YEAR 1891.

President—JOHN MACKEY.
Vice-President—MARTIN BIXBY.
Secretary—W. H. PAYNE.
Treasurer—J. J. ATHERLY.

This society has held weekly meetings during the year, except during the busy fruit season, when they were discontinued to be resumed again when the members had more leisure to attend them. The meetings have been usually well attended and the discussions animated and profitable. A year of plenty coming after a year of scarcity, filled every heart with hope. The best modes of caring for and marketing the promised abundant crop was the all-important topic, and new methods were eagerly taken up and discussed with great interest. Such questions as condition of our orchards; new varieties of fruit; what shall we plant? best varieties of fruit for profit; why do our trees become black, scabby, and gummy? is it practicable to sell our own fruit and fix the price? seed and vegetable growing; commercial gardening; improvements in town and country; peach-growing and apple-growing; fertilizing and spraying; planting, cultivating and trimming, each came in for a share of our attention. Sometimes visiting fruitgrowers met with us, and, while willing to tell them all we knew, we were pretty sure to draw out all they knew. Yellows was not discussed —we are through discussing that question, for, whenever a peach-grower finds a tree affected with yellows, he does not rest until he gets his ax and cuts it down; and he don't need have anyone tell him to, either.

The annual dinner, given by the ladies of the society, January 14, is the one day of the year marked with a white stone in this society; not alone for a good dinner and a nice programme, but that the fruitgrowers and their families can all meet together for renewal of acquaintance and for a good time generally.

The most important of the subjects debated during the year was that of fruit packages, and whether we should have full packages, pecks, half-bushels, and bushels, or use the common fifth-bushel. The aldermen of Chicago had started the ball rolling by passing an ordinance forbidding the sale of fruit packages except in aliquot parts of a bushel, and a state stat-

ute defined what a bushel was. As South Haven had always stood at the front for honesty of packages, and the law seemed to require it, it was resolved to discard the fifth peach basket and use only full pecks, and to set our neighbors who still propose to use fifth baskets, a good example. Most of the fruitgrowers signed the agreement, and the factory was notified and it agreed to make them; but, alas! for the frailty of human nature, it was soon claimed that the fifth baskets sold for the same price as the full pecks (buyers would not discriminate), and one by one they all returned to the old ways, and another stone was added to the place said to be paved with good intentions.

The discussion on the marketing of our own fruit brought up again the old question of a commercial union, and every one seemed to be in favor of it, if it would work. Two plans were proposed and signatures obtained. Both of these plans "died aborning," and another paving stone was added to the pile.

A letter was received from Prof. KEDZIE of the Michigan Agricultural college, proposing to send some of the imported sugar-beet seed to the society, for the members to plant, and after keeping account of time of planting, soil, culture, cost of labor, amount or weight per acre, send, with three average beets to the college for analysis. About twenty persons applied for seed; but, as the returns are not in yet, no idea of the result can be obtained. As the season was very dry, the beets did the best on moist land.

An immense crop, the largest on record, has filled the heart of the husbandman with happiness, although the moderate prices obtained for fruit have had a tendency to check extravagance, so that the season of 1891 has been on the whole satisfactory.

WASHTENAW HORTICULTURAL SOCIETY.

OFFICERS FOR 1892.

President—J. AUSTIN SCOTT.
Vice-Presidents—EVART H. SCOTT, J. J. PARSHALL, WM. MCCREERY.
Recording Secretary—J. GANZHORN.
Corresponding Secretary—E. BAUR.
Treasurer—J. ALLMEND.
Executive Committee—WM. F. BIRD, A. A. CROZIER, J. C. SCHENK, H. C. MARKHAM.
Ornithologist—Prof. J. B. STEERE.
Climatologist—Prof. M. W. HARRINGTON.
Botanist—Prof. V. M. SPALDING.
Hygienist—Prof. J. C. VAUGHAN.
Entomologist—A. A. CROZIER.

At the January meeting, after discussion of the unfavorable results of combined shipments to Detroit in the "Ann Arbor Fruit Car," and some general remarks by President SCOTT, Mr. W. F. BIRD spoke on specialties in fruitgrowing. He cited examples of marvelous success by specialists in the culture of strawberries, apples, celery, etc. Specialists can attend

better to the details of their business. Those who had too many irons in the fire would have some burnt. "The older I grow the more I am convinced that the man of one idea is the successful man."

E. BAUR supported these ideas, stating that in Germay itinerant teachers (Wanderlehrer) of horticulture and agriculture were especially trained by the government to give instruction in agriculture and its kindred branches in the common schools, especially in the villages where the farmers and fruitgrowers predominate. The tiller of the soil is the backbone of the country. Let him be trained in his important calling as early as possible.

Mr. GANZHORN found some difficulties in specialties. We started out in peach-culture. Three cold winters in succession killed most of our trees and we have not recovered yet; started in grape-growing, which was interrupted by rot and ended in failure. One who had means enough to bridge over could carry out specialties."

Mr. N. FARNUM of North Bass Isle, O., was called upon. He said he had been engaged in grape-growing thirty years but does not know how to do it yet.

Mr. ALLMAND stated that he had made a succcess of fruitgrowing in so far that he could make ends meet, but he could not raise such crops as Mr. BIRD cited. He grew the first strawberries for the Ann Arbor market.

Mr. GANZHORN read a very interesting paper on pear blight, the leaf blight and the fire blight.

Quite a discussion followed, in which pear trees were named which are not subject to blight and the reason why was demonstrated. Slow-growing pear trees suffer least from blight. Tyson, Sterling, Seckel, exempt from blight. Gifford, Bartlett, Anjou, Bosc, suffer least from blight. Clapp's Favorite, Flemish Beauty, Congress, suffer most.

The February meeting was of unusual interest. President J. AUSTIN SCOTT, who had just returned from the inauguration of his son to the presidency of Rutgers college, was in the chair, full of youthful vigor and good-will toward every one.

After the reading of the minutes of last meeting, a letter by C. F. PARSHALL was read, containing a statement of expenses incurred by transportation of berries by the Ann Arbor fruit car and a request by Mr. PARSHALL to be relieved from the chairmanship of the committee on transportation.

Mr. J. C. SCHENCK was added to the committee and intrusted with the charge to find out the shipments of those who shipped with this car.

The corresponding secretary read a petition to the legislature of the state, in which that honorable body was requested to enact such laws as will give to the state a uniform system for the improvement of the highways, by the appointment of a state commissioner of roads and bridges, who should be an engineer, and by building of some roads between the large cities and villages by general taxation or by any measure that honorable body may devise. After a very animated discussion the petition was adopted and signed by the officers and members of the society and other citizens.

Mr. G. F. ALLMENDINGER'S address on adulteration of fruit products received a very hearty response and a series of resolutions was adopted asking the representatives and senator from this county to use their influence in the legislature to create a food commission, as Ohio, Wisconsin, Minnesota, Iowa, and other states have done. The people of this state are paying many thousands of dollars yearly for adulterated fruit products

which are sold for one reason only: to allow some one an unreasonable and undeserved profit. The sale of such products is an outrage upon the producer and consumer alike. It hurts every farmer and fruitgrower especially, and the cost of supporting a commission which will relieve the people of the extortions practiced will be saved many times, besides providing a purer food supply, the value of which can not be estimated by dollars and cents. Stuff which never saw an apple sold for cider vinegar, and bogus jellies manufactured by the most noxious methods, should be branded by their true name.

The corresponding secretary read a paper on the origin of the so-called Seckel pear, proving that this pear was misnamed. The benefactor who gave us this highest type of the American pear was a German by the name of SICHEL who raised this pear tree from seed at Baltimore, Md., and that this pear should be called Sichel, or, if this name should be translated into English, Sickle would be more proper. There is no such name as Seckel in all Christendom. The writer saw a tree at Economy, Pa., obtained about seventy years ago from Mr. SICHEL of Baltimore.

Mr. GANZHORN remarked that it was desirable to address Mr. THOS. MEEHAN of Philadelphia, who claims that the pear in question originated in Philadelphia by a Mr. SECKEL, and if Mr. SICHEL was really the originator the American Pomological society should be requested to change the name of this pear.

Mr. HERMAN MARKHAM had a fine exhibit of fifteen varieties of potato which were of the finest kinds grown.

Mr. J. J. PARSHALL gave notice that the name pomological should be changed to horticultural at the next meeting. This change, he thinks, would induce many horticulturists to join our society.

President J. AUSTIN SCOTT conducted the April meeting of the society with his usual promptness and executive ability. The corresponding secretary read the resolutions in memoriam of Prof. ALEXANDER WINCHELL. Mr. GANZHORN spoke of the good work the professor accomplished by an article on the "Michigan Fruit Belt," published in Harper's Monthly in 1866. President SCOTT alluded to the noble character of Prof. WINCHELL, with whom he was personally acquainted, and thanked EMIL BAUR for the resolutions of condolence and the notes on the publications of the professor, by which the advantages the state of Michigan offers to agriculture and horticulture became known, not only in this country but all over Europe. He hoped that this legislature would recognize the services which the late professor gave to the state, paying for these publications out of his own pocket. This state owes a debt to the memory of Mr. WINCHELL which was denied him by the legislature of 1871, and ever since.

Mr. GANZHORN spoke of the care of fruit trees after planting. So many trees die for want of cultivation during the hot season and the nursery man gets the blame for it. Many fitting remarks were made by others on this topic.

The president gave a list of apples for general use, based on the best results of his own experience, as follows:

For Family Use—(summer) Early Harvest, Yellow Transparent, Red Astrachan, Early Strawberry, Sweet Bough, American Summer Pearmain; (fall) Gravenstein, Porter, Mother, Shiawassee, Norton's Melon, Snow, Williams' Favorite, Grenniwinkle Sweet, Red Streak, Green Sweet, Fall Pippin; (winter) Jonathan, R. I. Greening, Northern Spy, Red Canada,

King, Yellow Bellflower, Belmont, Austin (new), Baldwin, Wagener, Talman Sweet, Ladies' Sweet, Roxbury Russet.

The paper on the profitableness of the tomato, by S. D. LENNON, was highly appreciated and many questions were answered of this intelligent horticulturist. "It takes knowledge and experience and a good market to succeed. With a canning-factory in our midst, the growing of tomatoes at 20c per bushel would be profitable. A neighboring city has three factories in successful operation, making it pay for the grower. Formerly this vegetable was grown for ornament. Now there is scarcely a family that does not use one to five bushels in a single season. Of late years the growing of tomatoes in the south, for our northern markets, has become a mine of wealth. In some localities they are shipped, not simply by the car, but by the whole train at once, with big pay to growers, shippers, and sellers.

The remarks on our roads by EMIL BAUR were short. The roads are bad this spring. The damage to man, beast, and wheel is great. It would pay to have a better system of road-making. We have not everywhere coarse gravel handy. The roadbed, as shown by Prof. DAVIS, must be kept dry. A stone crusher is a necessity for city and country roads.

H. C. MARKHAM'S discourse, with specimens of the earliest and best potatoes, presented to the meeting, was highly appreciated. The following varieties were shown in their succession: Tonhocks (very early), Sunlit Star, Everitt, Summit, Finche's Perfection, Early Pearl, Rose's 74.

JOHN ALLMAND gave his experience in strawberry-growing. He was the first grower here and made some money at 35c per quart, until they came down to 5c, when he lost money. Haverland, Michel, Bubach, and other varieties were recommended.

At the May meeting, A. A. CROZIER, chairman of the committee on diseases of the peach tree, reported that the committee sent twigs of diseased peach trees to Mr. ERWIN F. SMITH of the department of agriculture at Washington. Prof. SMITH answered that he would be here at an early date to investigate the diseased trees.

The discussion on prevention of washing in vineyards, opened by W. F. BIRD, elicited a good many practical ideas.

Mr. TUCKER presented to the meeting some apple buds infested by a green louse, which bores holes into the heart of the bud, like the green grapevine beetle bores into the grapevine bud. Mr. TUCKER is afraid that the crop of early apples at Ypsilanti is already destroyed. He addressed Prof. A. J. COOK of the Agricultural college, in regard to the remedy. The professor recommends kerosene emulsion.

As these lice seem to infest every apple tree in Ann Arbor and vicinity, perhaps all through the county, the kerosene emulsion should be applied by a force pump at once.

Mr. J. AUSTIN SCOTT presided at the June meeting. Mr. GANZHORN reported that about Ann Arbor the prospects for peaches were never better.

Mr. B. J. CONRAD was chosen to fill the vacancy of CHARLES PARSHALL, resigned, as chairman of the committee on transportation. Mr. BAUR reported that all debts are paid in connection with transportation of last year.

There was a splendid display of fruit. Mr. GANZHORN exhibited the

following cherries: Elton, large pale yellow and red, one of the best; Napoleon, nearly the same color, larger; May Duke, large dark red; and Governor Wood.

LUTHER PALMER of Dexter exhibited the largest strawberries. Jessie, his best yielder, Jewell, Bubach, Belmont. Mr. JOHN SCHENK of Ann Arbor town had the largest Haverland, Eureka, Pineapple, and other sorts of strawberry.

At the August meeting Mr. GANZHORN, in his interesting paper on the sale of fruit, stated: This is the most important question before fruit-men. I can well remember when the foremost questions were: Which is the best location, what varieties to plant, how to cultivate and prune? Will not the business be overdone? The timid ones were afraid the business would come to grief, when prices of grapes, shipped from California, dropped to three cents per pound. The wholesale price of grapes, which used to be ten cents per pound, dropped to 1½ cents in the principal markets. I used to ship peck crates of peaches to wholesale houses in Chicago for $2. One of my neighbors sold his peaches right under the trees for $8 per bushel. Peach men then said, 10 per cent. is too much for selling fruit, but as the net increase from fruit was so large no attempt was made to reduce the rate of commission. We have now come down to the bedrock of our business, and it has become a question of the survival of the fittest. We can only hope to succeed by trimming away unnecessary expenses. We have made a beginning by breaking away from the express to shipping by freight. Fruit men must combine. It is wasteful to make so many individual and small shipments to one market. In many cases there is a waste in cartage and freight, both in shipping and in return of empty packages. There is as much freight on three empty crates or baskets, as on twenty-five. The commission man has to deal and keep accounts with so many small lots, while he would save much clerical service, postage, and draft expenses had he but one party to deal with from one place, instead of so many. A single fruit-farmer in Illinois sells 100 carloads of fruit for his neighbors. The grape crop of Chautauqua county, between Buffalo and Dunkirk, N. Y., amounting from 1,600 to 2,000 carloads, is sold in charge of one man. Agents are sent out to make sales of carload lots at different places, as Chicago, St. Paul, and even down to Georgia and Texas. Delaware sells her fruits largely by auction. California has developed great skill in grading, packing, and sale of fruits, otherwise their shipment to distant markets would be impossible. We shipped in the neighborhood of 20,000 bushels of peaches last year at an average price of $2 per bushel, the crops amounting to $40,000. The commission on the same is about $4,000; on berries, perhaps $1,000, making a total of $5,000. Although we pay large sums of money every year for the sales of our fruit, we meet with frequent losses for want of better distribution. The commission man takes no risk with us; we have to bear all the loss. Against wasteful gluts we can do much ourselves by preparing for canning, evaporating, manufacture of jellies and fruit syrups. These canned goods can not well be put up by individuals. The factory will be the proper place, where a surplus of fruit can be disposed of on a large scale, and sold to advantage under properly organized facilities. In 1889 we averaged but $2 per bushel for berries. Such seasons will come again, and, in such cases, the saving of unnecessary expenses may be all that

is left for our earnings. Fruit will be raised on a larger scale in the future, and the sooner we adapt ourselves to the inevitable, the better for us.

Mr. W F. BIRD addressed the society on the best pumps for the application of insecticides. He exhibited two pumps of the Field Force Co., one a large, double-acting pump for orchards, the other a knapsack sprayer made of copper, for the application of the Bordeaux mixture and other poisons among grapes, potatoes, and small fruits.

The name of this society was changed from pomological to horticultural by a majority of votes. This opens the doors to all our vegetable gardeners, florists, and farmers. They will receive a hearty welcome.

Different varieties of winter apple and the Champion peach were discussed.

CONSTITUTION

OF THE

MICHIGAN STATE HORTICULTURAL SOCIETY.

ARTICLE I.—NAME, TERRITORY, AND OBJECTS.

The name of the society shall be the Michigan State Horticultural society; and its territory shall be the state of Michigan. Its objects shall be the development of an adequate appreciation of the peculiar adaptation of the soils and climate of the state to the pursuit of horticulture in all its branches; and the collection and dissemination of information bearing upon the theory and practice of the same, as well as upon the arts and sciences directly or indirectly associated therewith, or calculated to elevate or improve the practice thereof.

ARTICLE II.—OFFICERS AND MODE OF ELECTION.

The officers of the society shall be a president, a secretary, and a treasurer, together with an executive board of six members, aside from the president, secretary, and treasurer, who shall be *ex officio* members of the said board.

Said board shall designate one of its members as vice-president. The officers shall be elected by ballot.

ARTICLE III.—A QUORUM.

Four members of the executive board shall constitute a quorum for the transaction of business at any meeting of said board: *Provided*, That each of the members thereof shall have been notified, in the usual manner, of the time, place, and object of such meeting.

ARTICLE IV.—ANNUAL MEETING AND ELECTION OF OFFICERS.

The annual meeting of the society, for the election of the officers specified in Article II, shall occur on the first Wednesday of December in each year, and the officers then elected shall enter upon the discharge of their duties as such, on the first day of January next ensuing; but in case of a failure to elect at that time, such election may be held at a subsequent time at an adjourned meeting, or at a meeting of the society called for that purpose, in the usual manner.

ARTICLE V.—TERMS OF OFFICE.

The officers specified in Article II shall hold their offices until the thirty-first day of December of the year for which they were elected, and thereafter until their successors shall have been elected, and shall have signified to the secretary their acceptance: *Provided*, That the terms of office of the six members of the executive board shall be so arranged that but two regular vacancies shall occur in each year.

ARTICLE VI.—ANNUAL AND LIFE MEMBERS.

Any person may become a member of the society for one year by paying to the treasurer the sum of one dollar; and the yearly term of all annual memberships shall expire on the thirty-first day of December of the year for which they were taken, but be regarded as continuous, except as may be provided by the by-laws. Any person may become a life-member by the payment at any one time of the sum of ten dollars into the treasury of the society.

ARTICLE VII.—AMOUNT OR LIMIT OF PROPERTY.

The society may hold real and personal estate to an amount not exceeding twenty thousand dollars.

ARTICLE VIII.—BY-LAWS.

By-laws for the government of the society shall be framed, and when needful, amended by the executive board; but changes therefor may be at any time proposed by the society in general meeting.

ARTICLE IX.—AMENDMENTS.

This constitution may be amended at any regular meeting of the society by a vote, by ballot, of two thirds of all the members present and voting: *Provided*, That notice of such proposed amendment, specifying its purport, shall have been given at the last previous regular meeting.

BY-LAWS OF THE MICHIGAN STATE HORTICULTURAL SOCIETY.

I.—THE PRESIDENT.

1st. The president shall be the executive officer of the society, and of the executive board; and it shall be his duty to see that the rules and regulations of the society, and of the executive board, are duly enforced and obeyed.

2d. He may, in his discretion, and in the lack of needful rules, during the recesses of the society and of the board, prescribe rules for the management of the interests or business of the society, such rules to continue

in force till the next session of the executive board, and until by its action they shall have become no longer necessary.

3d. He shall act in conjunction with the secretary in the preparation of programmes, or orders of business for the sessions of the society; and in the devising of plans and processes for the maintenance of its interests.

4th. He shall have the best interests of the society at heart, and shall lead in forwarding any and all enterprises calculated to add to its permanency, or to increase its usefulness, and establish it more firmly in the public confidence.

II.—VICE-PRESIDENT.

The vice-president shall perform the duties of the president in case of the absence or inability of that officer; and may be called upon by the president to assume the duties of the chair at any meeting of the society or executive board.

III.—THE SECRETARY.

1st. The secretary shall be the recording, corresponding, and accounting officer of the society, and he shall also be, jointly with the business committee, its financial and auditing officer.

2d. He shall incur no expenditure of a large or doubtful character except with the sanction of the executive board or of the business committee.

3d. He shall submit all bills or claims against the society to the business committee for approval, and indorsement to that effect, before drawing his order upon the treasurer for the payment of the same.

4th. He shall attend all meetings of the society, and of the executive board, and shall keep a faithful record of their proceedings.

5th. He shall sign all certificates of membership, and all diplomas and certificates of merit awarded by the society.

6th. He shall have charge of the society's books and papers, excepting only such as by the advice or direction of the executive board shall be placed in charge of the librarian, and he shall be responsible to the board for the safe keeping of the property placed in his charge.

7th. He shall be the custodian of the seal of the society, and shall have authority to affix the same to documents when needful.

8th. He shall seek, by all suitable means, to secure the fullest announcement of the meetings of the society in this state, as well as in adjacent states, when such shall be found desirable.

9th. He shall, so far as practicable, cause the transactions of the society, together with such valuable or interesting papers as shall be read at its sessions, to be properly published, and thus placed within reach of the state.

10th. It shall also be his duty, yearly, to prepare for publication the annual report of the society, together with such other matter as he shall deem proper—he being aided in the selection of such matter by an advisory committee of the executive board.

IV.—THE TREASURER.

1st. All the funds of the society shall be paid into the hands of the treasurer.

2d. He shall disburse the moneys of the society that shall come into his hands only upon the order of the secretary, countersigned by the president.

3d. He shall keep the moneys received by the society for life memberships as a distinct fund, and shall invest the same under the advice and direction of the executive board applying only the interest accruing thereon to the purposes of the general fund.

4th. Immediately upon assuming his office, and before entering upon its duties, he shall execute to the society an official bond with sufficient sureties, conditioned for the safe keeping and disbursement of the moneys of the society, and for the proper discharge of the further duties of his office, in such sum as shall be specified by the executive board. Such bond shall receive the approval of the president, and shall be deposited with the secretary.

5th. He shall at the close of each year, report to the executive board the amount of money that shall have come into his hands during the year, the sources from which it has been derived, and the disposition made of the same.

V.—THE LIBRARIAN.

1st. The librarian shall have the custody of the library of the society. He shall be appointed by the executive board, and may be displaced at its pleasure.

2d. He shall act jointly with the secretary in the care and arrangement of the same, and in the reception, custody, and disposal of the volumes of the transactions annually supplied to the society by the state.

3d. He shall have the custody of the rooms assigned to the society at the state capitol, together with such books and other property as the society or the board shall direct to be deposited therein.

4th. He shall report annually, at the close of the year, to the executive board the amount and condition of the property in his hands.

VI.—THE EXECUTIVE BOARD.

1st. The executive board shall enact all rules and regulations for the management of the affairs of the society, determine the salaries of its officers, and assume the control and management of its exhibitions.

2d. It shall have power to displace any officer of the society for neglect of duty or abuse of position, and to fill all vacancies by appointment, to continue till the next annual election.

3d. The board shall hold four regular sessions during the year, to occur at the times and places for the regular meetings of the society.

4th. Other meetings may be called by the secretary, under the advice or direction of the president, or of a majority of its members, at such times and places as may be deemed most convenient; but in all such cases each member must be notified of the time, place, and object of such meeting.

5th. It shall be the duty of the board to carefully guard the general

interests of the society, to watch over its finances, and to provide for its necessities as they shall arise.

6th. All important measures shall be submitted to this board, but they may by the board be re-submitted to the society with recommendations.

7th. The board shall, at the annual meeting submit through the secretary, in connection with the reports of officers, such further report upon the condition, interests, and prospects of the society as it shall judge necessary or expedient.

8th. Two members of the executive board are to be elected each year, to hold the office for three years, but if any such member shall absent himself from two or more consecutive meetings of the society, and of the board without reason satisfactory to the board, the said board may, in its discretion, consider the office vacant, and proceed to fill such vacancy by appointment, to continue to the next annual election.

VII.—THE BUSINESS COMMITTEE.

1st. It shall be the duty of the executive board, annually, upon entering upon the duties of the new year, to appoint from their own number, three members, who shall constitute a business committee for the year.

2d. All accounts or claims against the society, when presented to the secretary for payment, shall, before payment, receive the sanction and indorsement of the business committee.

3d. Such claims shall be submitted to this committee and approved in duplicate; one copy to remain with the secretary as his warrant for the payment of the same, and the other to be transmitted by him to the president, along with his order upon the treasurer, as his warrant for countersigning the same.

4th. It shall be the duty of the business committee, upon application of the secretary, during the recess of the executive board, to advise with him as to the expediency of making any contemplated but questionable expenditure for which occasion may arise during such recess.

VIII.—STANDING COMMITTEES.

1st. There shall be a standing committee on revision of the catalogue, to be composed of one member from each of the five districts into which the state is, for this purpose, divided, with one member chosen from the state at large, who shall be the chairman of the committee.

2d. Each member of said committee (except the chairman) is empowered and expected to choose a sub-committee for his district, of which he shall be chairman.

3d. It shall be the duty of each sub-committee to collect and report, each year, to the general chairman, such facts respecting fruit culture in the district as shall promise to be of value in the revision of the catalogue.

4th. There shall be a standing committee on new fruits, to consist of a chairman, with as many associates as such chairman shall find it desirable to appoint.

5th. Such other standing committees may from time to time be appointed by the executive board as, in its discretion, it shall deem desirable or necessary.

6th. All standing committees are expected to report at the annual meeting in December, any information of value to the society or its members

that may have come to their knowledge during the year, as well as any scientific theories, deductions, or facts that, in their opinion, may be useful in advancing the objects for which the society is laboring.

IX.—LIFE MEMBERSHIP FUND.

1st. All moneys coming into the treasury of the society in payment for life memberships shall constitute a perpetual fund, to be known as the life membership fund.

2d. The principal of this fund shall be invested by the treasurer under the advice and direction of the executive board.

3d. All interest accruing upon any portion of said fund shall constitute and become part of the fund of the society devoted to the payment of its ordinary expenses.

X.—MEETINGS OF THE SOCIETY.

1st. The society shall hold its first regular meeting for the year during the month of January or February for the inauguration of the officers chosen at the annual meeting held the previous December, as provided in article IV of the constitution, and also to arrange its plan of operations for the year.

2d. Its second regular meeting shall be held in the month of June at such date as shall best accommodate an exhibit of the early summer fruits.

3d. Its third regular meeting shall be at its annual exhibit of autumn and winter fruits, in the month of September or October.

4th. Its fourth regular meeting shall occur in connection with its annual election of officers, on the first Wednesday of December, as provided in article IV of the constitution.

5th. The times and places for the occurrence of these regular meetings (excepting only the *time* of the annual meeting) shall be determined by the executive board.

6th. Other meetings may be called by the secretary, under the advice or direction of the members of the executive board, at times and places by them deemed expedient.

7th. In case of the calling of a special meeting for the election of officers of the society, in consequence of any failure to elect at the annual meeting, as provided in section IV of the constitution, all persons entitled as members to vote at such annual meeting shall be considered as retaining such membership for such purpose until such election, and until such officers so elected shall have been inducted into office.

XI.—RULES FOR DISCUSSIONS, ETC.

1st. The deliberations and discussions of the society shall be conducted in accordance with ordinary parliamentary usages.

XII.—AUXILIARY SOCIETIES.

1st. The society shall in all reasonable and proper ways encourage the formation of local horticultural or pomological societies auxiliary to this society in all such counties or other municipalities of this state as shall afford a reasonable prospect that they will be able, effectively, to maintain the same.

2d. It shall be the policy of this society in supervising the organization of such local auxiliaries to secure an identity of constitutional provisions

throughout, and in so doing to insure harmony among them; but at the same time it will not discourage the including by them of special or local objects in cases in which such shall be found desirable, so long as the introduction of the requisite provisions therefor into the constitution and by-laws of the auxiliary society shall not be deemed likely to interfere with the harmonious workings of the whole.

3d. Any person may become a full member of an auxiliary society, for one year, by paying into its treasury the sum of one dollar; and a compliance with the provisions of clause fifth of these by-laws shall constitute him also a member of this society, for the same term.

4th. The wife, and the resident, single or unmarried daughters of any full member, may also become members of such auxiliary society upon the payment of fifty cents each: *Provided*, That in such case such entire family shall become entitled to a single copy, only, of the current volume of the transactions of this society.

5th. On receipt of the names of such members, with the required fees, the secretary shall immediately transmit their names and postoffice addresses, together with half the membership fee of each, to the secretary of this society, who shall record the same and pay the money into the treasury for the benefit of the general fund.

6th. It shall be the duty of the secretary, on receipt of such remittance, with list of members, to supply such auxiliary society with a certificate of membership in this society for one year, together with a copy of the current volume of transactions for each full member so remitted for.

7th. The proceedings of such auxiliary society shall, at the close of the year, be forwarded, in succinct form, to the secretary of this society, to be by him incorporated into the annual volume of transactions, accompanied by a list of its members for the year.

8th. The auxiliary societies shall, as far as practicable, be made the medium for the distribution of the annual volumes of the transactions of the society, the nuclei for its meetings, and the means of creating interest therein, as well as the means of collecting such facts or other information or material as shall, from time to time, become needful or desirable in the conducting of its various operations.

XIII.—AMENDMENTS, ADDITIONS, SUSPENSIONS.

1st. Amendments or additions to these by-laws may be made by a majority vote of the executive board, at any meeting; but if objections shall be made the same shall "lie upon the table" till the next regular meeting of the board.

2d. These by-laws, or any one or more of them may be suspended for the time, by order of a majority of all the members of the society present and voting.

3d. A proposition in the general meeting of the society for an amendment or addition to these by-laws shall be referred to the executive board for consideration and decision; but the society may submit therewith its advice or request.

4th. All amendments of the constitution and by-laws of auxiliary societies shall, before they shall take effect, be submitted to the executive board of this society, by whom their approval or rejection shall be considered upon the principle provided in section XII, clause 2, and the determination of said executive board shall be final and binding upon the auxiliary society.

LIFE MEMBERS OF THE STATE HORTICULTURAL SOCIETY.*

Name.	P. O. Address.	County.
Adams, H. Dale	Galesburg	Kalamazoo.
Adams, Mrs H. Dale	Galesburg	Kalamazooo.
Allis, E. W.	Adrian,	Lenawee.
Allis, Miss Mary C.	Adrian	Lenawee.
Archer, Thomas	St. Joseph	Berrien.
Armitage, James	Monroe	Monroe.
Arnold, W. D.	Ionia	Ionia.
Avery, C. P.	Old Mission	Grand Traverse.
Bagley, John J. (deceased)	Detroit	Wayne.
Bailey, L. H.	South Haven	Van Buren.
Bailey, L. H., jr.	Ithaca	*New York.*
Baldwin, H. P.	Detroit	Wayne.
Baldwin, J. D.	Ann Arbor	Washtenaw.
Ball, John (deceased)	Grand Rapids	Kent.
Barnett, G. W., 159 South Water street	Chicago	*Illinois.*
Bates, T. T.	Traverse City	Grand Traverse.
Baxter. W. J. (deceased)	Jonesville	Hillsdale.
Beal, W. J.	Agricultural College	Ingham.
Becker, Albert J.	Saginaw	Saginaw.
Bidwell, H. E.	Plymouth	Wayne.
Blodgett, D. A.	Grand Rapids	Kent.
Brackett, G. B.	Denmark	*Iowa.*
Bradfield, Edward (deceased)	Ada	Kent.
Bragg, L. G.	Kalamazoo	Kalamazoo.
Bruchner, George W.	Monroe	Monroe.
Bryant, C. T.	South Haven	Van Buren.
Bullock, R. D. (deceased)	Jackson	Jackson.
Burham, W. P.	Ionia	Ionia.
Burrows, George L.	Saginaw City	Saginaw.
Caie, Robert	Yarmouth	*Nova Scotia.*
Castello, George	Saginaw City	Saginaw.
Chandler, Z. (deceased)	Detroit	Wayne.
Chapman, H. B. (deceased)	Reading	Hillsdale.
Chapman, Alvin	Bangor	Van Buren.
Chapman, Austin B.	Rockford	Monroe.
Chilson, Nathaniel	Tower City	*Dakota.*
Chilson, Miss Ida	Tower City	*Dakota.*
Clark, M. W.	Jackson	Jackson.
Cook, A. J.	Agricultural College	Ingham.
Cook, W. N.	Grand Rapids	Kent.
Cooley, Elisha (deceased)	Jackson	Jackson.
Cooper, George S.	Ionia	Ionia.
Crosby, M. S.	Grand Rapids	Kent.
Crozier, A. A.	Washington	*D. C.*
Curtis, H. W.	Old Mission	Grand Traverse.
Cushman, E. H.	Euclid	*Ohio.*

* NOTE.—A Life Membership is $10. The fund thus gathered is invested in good securities and only the interest employed for general purposes.

Name.	P. O. Address.	County.
Davis, P. C.	Kalamazoo	Kalamazoo.
Day, Benjamin	Ann Arbor	Washtenaw.
Dean, A. J.	Adrian	Lenawee.
DeLisle, Wm. H.	Bay City	Bay.
Dickinson, G. W. (deceased)	Grand Rapids	Kent.
Dieckman, Mrs. Josephine M.	East Saginaw	Saginaw.
Deitrich, C. J.	Chicago	*Illinois.*
Dixon, A. S.	East Saginaw	Saginaw.
Dorr, S. W.	Manchester	Washtenaw.
Doyle, Thomas	Monroe	Monroe.
Dyckman, A. S.	South Haven	Van Buren.
Dykman, J.	East Saginaw	Saginaw.
Edmiston, D. G.	Adrian	Lenawee.
Ferry, D. M.	Detroit	Wayne.
Ferry, T. W.	Grand Haven	Ottawa.
Fields, Miss Jennie E.	East Saginaw	Saginaw.
Flowerday, Robert	Detroit	Wayne.
Foster, W. D. (deceased)	Grand Rapids	Kent.
Foster, Mrs. Mary E.	Ann Arbor	Washtenaw.
Fowler, S. W.	Manistee	Manistee.
Fuller, S. L.	Grand Rapids	Kent.
Fuller, S. R.	Eaton Rapids	Eaton.
Garfield, Chas. W.	Grand Rapids	Kent.
Geddes, David	Saginaw	Saginaw.
Gibson, Mrs. W. K.	Jackson	Jackson.
Gilbert, John (deceased)	Ovid	Clinton.
Graham, Elwood	Grand Rapids	Kent.
Greening, J. C.	Monroe	Monroe.
Griggs, George W. (deceased)	Grand Rapids	Kent.
Guild, E. F.	East Saginaw	Saginaw.
Hall, Frederick (deceased)	Ionia	Ionia.
Hanford, H. P. (deceased)	Bristol	*Indiana.*
Hannah, Perry	Traverse City	Grand Traverse.
Hathaway, B.	Little Prairie Ronde	Cass.
Haviland, J. B. (deceased)	Traverse City	Grand Traverse.
Hayden, Mrs. H. A.	Jackson	Jackson.
Humphrey, J. W.	South Haven	Van Buren.
Husted, James D.	Vineyard	*Georgia.*
Husted, Noah P.	Lowell	Kent.
Ilgenfritz, I. E.	Monroe	Monroe.
Ilgenfritz, C. A.	Monroe	Monroe.
Ives, Caleb	Monroe	Monroe.
Jerome, Mrs. David H.	Saginaw City	Saginaw.
Johnson, William	Vassar	Tuscola.
Kedzie, R. C.	Lansing	Ingham.
Kelsey, E. P.	Ionia	Ionia.
Kidd, J. H.	Ionia	Ionia.
Klein, F. J., 156 St. Aubin ave.	Detroit	Wayne.
Knapp, S. O. (deceased)	Jackson	Jackson.
Knapp, E. U.	Grand Rapids	Kent.
Kniseley, A. J.	Benton Harbor	Berrien.
Lawton, George W. (deceased)	Lawton	Van Buren.
Lincoln, L. C.	Greenville	Montcalm.
Lincoln, Mrs. L. C.	Greenville	Montcalm.
Linderman, Harvey J. (deceased)	South Haven	Van Buren.
Linderman, A. T.	Whitehall	Muskegon.
Littlejohn, F. J. (deceased)	Allegan	Allegan.
Loomis, P. B.	Jackson	Jackson.
Lyon, T. T.	South Haven	Van Buren.
Mann, S. B.	Glenwood	*Florida.*
Marshall, Wm. A.	Old Mission	Grand Traverse.

Name.	P. O. Address.	County.
Mason, L. M.	East Saginaw	Saginaw.
Mason, Mrs. Sarah A.	East Saginaw	Saginaw.
McCallam, E. H.	Lansing	Ingham.
McClatchie, G. C.	Ludington	Mason.
McDiarmid, James D.	Bear Lake	Manistee.
McNaughton, Robert T.	Jackson	Jackson.
Mitchell, W. H. C.	Traverse City	Grand Traverse.
Moores, J. H.	Lansing	Ingham.
Monroe, C. J.	South Haven	Van Buren.
Monroe, Judge (deceased)	Lawrence	Van Buren.
Montague, A. K.	Traverse City	Grand Traverse.
Nabors, Nellie S.	Flint	Genesee.
Nichols, W. W.	Ann Arbor	Washtenaw.
Noble, W. A.	Monroe	Monroe.
Odell, Samuel W.	Muskegon	Muskegon.
Palmer, Thomas W.	Detroit	Wayne.
Parmelee, George (deceased)	Old Mission	Grand Traverse.
Parmelee, Mrs. George (deceased)	Old Mission	Grand Traverse.
Parke, Mrs. Amos S.	East Saginaw	Saginaw.
Parsons, Philo	Detroit	Wayne.
Partridge, B. F.	Bay City	Bay.
Pearsall, S. M.	Grand Rapids	Kent.
Perry, George L.	Lansing	Ingham.
Petty, Thomas	Spring Lake	Ottawa.
Pierce, N. B.	Ludington	Mason.
Potter, E. M.	Manderson	*Nebraska.*
Ramsdell, J. G.	Traverse City	Grand Traverse.
Ramsdell, Mrs J. G.	Traverse City	Grand Traverse.
Ransom, W. D.	St. Joseph	Berrien.
Renwick, T. R.	Grand Rapids	Kent
Reynolds, E. H.	Monroe	Monroe.
Reynolds, H. G.	Agricultural College	Ingham.
Rich, Hampton	Ionia	Ionia.
Root, Amos	Jackson	Jackson.
Rose, D. Forsyth	East Saginaw	Saginaw.
Rose, Mrs. Sophie E.	East Saginaw	Saginaw.
Rowe, William	Grand Rapids	Kent.
Rowe, William N.	Grand Rapids	Kent.
Russell, Dr. Geo. B.	Detroit	Wayne.
Rust, C. E.	Ionia	Ionia.
Satterlee, James	Albany	*New York.*
Savidge, Hunter (deceased)	Spring Lake	Ottawa.
Scott, J. Austin (deceased)	Ann Arbor	Washtenaw.
Scott, Dr. Austin	Newark	*New Jersey.*
Scott, E. H.	Ann Arbor	Washtenaw.
Sessions, Charles A.	Mears	Oceana.
Sessions, Alonzo (deceased)	Ionia	Ionia.
Sessions, William	Ionia	Ionia.
Shirts, E. J.	Shelby	Oceana.
Shoop, Rev. D. R.	Hastings	Barry.
Sinclair, W. G.	Grand Rapids	Kent.
Sigler, Artimus	Adrian	Lenawee.
Slayton, Asa W.	Grand Rapids	Kent.
Sleeper, F. S. (deceased)	Galesburg	Kalamazoo.
Smith, E. T.	Ionia	Ionia.
Smith, N. E.	Ionia	Ionia.
Smith, H. H.	Jackson	Jackson.
Soule, J. B.	Fruitport	Muskegon.
Staunton, G. W.	Grand Rapids	Kent.
Stearns, J. N.	Kalamazoo	Kalamazoo.
Stearns, Ida L.	Kalamazoo	Kalamazoo.

Name.	P. O. Address.	County.
Steere, B. W.	Adrian	Lenawee.
Sterling, F. S.	Monroe	Monroe.
Sterling, J. M.	Monroe	Monroe.
Sterling, J. C. (deceased)	Monroe	Monroe.
Sterling, W. C.	Monroe	Monroe.
Sterling, W. P.	Monroe	Monroe.
Sterling, Mrs. Emma M.	Monroe	Monroe.
Stockbridge, F. B.	Kalamazoo	Kalamazoo.
Suttle, John (deceased)	Grand Rapids	Kent.
Taylor, George	Kalamazoo	Kalamazoo.
Taylor, George C.	Kalamazoo	Kalamazoo.
Thomas, H. F.	Jackson	Jackson.
Thompson, W. D.	Jackson	Jackson.
Thompson, J. P. (deceased)	Detroit	Wayne.
Towles, George W. (deceased)	Benton Harbor	Berrien.
Tracy, Will W.	Detroit	Wayne.
Vick, James (deceased)	Rochester	*New York.*
Vick, James, jr.	Rochester	*New York.*
Vick, Frank H.	Rochester	*New York.*
Vick, Charles H.	Rochester	*New York.*
Vick, E. Colston	Rochester	*New York.*
Wadsworth, W. R.	Lapeer	Lapeer.
Waite, Gilbert M.	Paw Paw	Van Buren.
Walker, S. S.	St. Johns	Clinton.
Watkins, L. D.	Manchester	Washtenaw.
Webber, William L.	East Saginaw	Saginaw.
Webber, George W.	Ionia	Ionia.
Webber, Miss Frances E.	East Saginaw	Saginaw.
Wells, H. G. (deceased)	Kalamazoo	Kalamazoo.
Whittlesey, John	St. Joseph	Berrien.
Wier, Antoine	Monroe	Monroe.
Wilde, Thomas	Herrington	Ottawa.
Williams, S. P.	Monroe	Monroe.
Winchester, A. O.	St. Joseph	Berrien.
Wooding, Charles F.	Lowell	Kent.
Woodward, David	Clinton	Lenawee.
Wurtz, Elias H.	East Saginaw	Saginaw.
Zeigler, J. C.	Saginaw City	Saginaw.

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